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THE OHIO AND MICHIGAN CONVENTIONS.

Both the Ohio and Michigan state electric light conventions were held last week. It was the thirteenth convention for the Ohio Electric Light Association and the fourth for the Michigan Electric Association. Ohio is much better favored as to number of central-station companies in the state than is Michigan, and consequently in point of numbers is much the larger association. The Michigan convention, however, did equally as good work in a less ostentatious way. The Michigan association takes in men connected with municipal electric lighting plants, in this respect being unlike most other state associations; but this apparently has little influence on the attendance and membership, as those engaged in operating any of the 100 municipal plants in the state must usually go down into their own pockets to meet convention expenses, with the result that they seldom attend. In the case of many municipal plants also, there is no one connected with the undertaking, owing to their small size, who could take an intelligent part in a convention of this kind. In Ohio the record of only 51 companies outside of the association, from a total of 180 in the state, is a remarkable one, and speaks well for the energy, tact and persistence of the officers as well as for the substantial benefits derived from membership. The Ohio convention program this year marked a radical departure from those of several years past, the change being along lines which we advocated at the close of last year's Ohio convention—namely, a reduction in the number of papers, in order to permit discussion, and having these papers mainly written by central-station men. This made the discussion the most prominent feature this year, as it should be in any convention. This, together with a convenient and accessible meeting place like Toledo, and active work by the officers, brought about an attendance which was a source of congratulation all around.

HOW ABOUT WIRELESS?

The strike of telegraphers now in progress, with the sending of messages seriously interfered with and the need, real or supposed, of guarding thousands of miles of lines against interference, shows that an inquiry as to the exact status of wireless telegraphy would now be particularly pertinent. There are divers companies with manifold installations, and at least a dozen kinds of alleged syntonic devices, and yet save for customary reports of incoming steamers, there is wonderfully little doing of which the public hears. Every little while the press reports tell of the marvellous apparatus of Prof. Dr. Von Pumpernickel by which the messages can be made to do figure-skating all over the empyrean, always dodging into the right window at the end of their stunt, yet somehow the steady work-a-day side of the matter still remains in the background. Some attempts at serious commercial transmission of messages over rather moderate distances have signally failed, and on the whole the last two or three years have been

singularly unproductive except in prospectuses. Of these there have been many copies per wireless message sent unless we are sadly misinformed. Along the seaboard there has been some reasonably successful work, and occasional striking feats bear evidence that behind all the dubious experiments and more dubious financiering lies something that the world really needs.

There is a great possibility lurking in the future, which has been hidden behind a sad lot of noisy humbug. It is high time that the serious workers in the field sunk their differences, scrapped their pet theories and came down to solid business. We know of no really great advance which has had so hard a lot. Of course, there are many inventors with systems to protect and theories to defend, both here and abroad, but the solemn truth is that they are industriously cutting each others' throats instead of advancing the art. It is a case where the greatest good can be attained only by working in harmony. Some steps have already been taken toward a consolidation of some of the various interests which should be productive of great good if carried far enough. There are many outstanding questions to be settled and an enormous amount of work to be done before the art gets fairly upon a commercial basis. Fighting will not bring the day of success an hour nearer. We are disposed to read the riot act to the whole contingent. Here we have one of the biggest things of the new century, a record of some wonderful achievements in long-distance transmission of messages, an almost unlimited field for marine usefulness and an unknown faculty for general work, which has failed of its mission thus far for petty and none too creditable reasons. Some day wireless telegraphy will come into its own. Just now perhaps the best work is being done under the auspices of various Governments for their own purposes. The Navy Department in this country has succeeded admirably within a particular sphere of operations, and is steadily extending the scope of its experiments. It really seems as if the private enterprise had fallen to the rear and governmental activity had pushed to the front. We hope for better things and wait patiently, but the period of exploitation seems indefinitely prolonged, and the procrastination grows tiresome.

Depreciation of Illuminants.

These are the days when those who are about to invest in electric illuminants will, if they are wise, figure carefully on the probable depreciation of the illuminant that is to be installed, bearing in mind the new illuminants that are about to come into the field. At the present time there is the practical certainty that there will soon be important advances in both the incandescent and the arc lamps on the market, but that does not help out the person or the central station that must make an installation at once without waiting for the newcomers to "arrive." With such it is a question of putting in that illuminant which will involve the least expenditure for initial investment plus operating cost for the next two or three years, when more efficient lamps will be generally available. Where lamps are turned on many hours per day the cost of energy to the consumer is so large per year that it is usually best to install the most efficient illuminant that can be found, because the saving will be so great that the installation can be thrown on the scrap pile in two years and still leave the user ahead of the game. Where the lamps are to be used only a short time each day, the cost of changing the installation in two or three years becomes a much larger proportion of the total cost, and it may figure out that it is best to put in an uneconomical system now which will involve low cost of future change rather than to save on operating expenses at present. Each case presents its own problems. This question has been coming up with great frequency lately and we know of some important contracts that have hinged upon it.

Municipal Bonds.

It deserves note that New York City has been unable to sell its bonds at the old rates of interest, and is now compelled to offer 4½ per cent, the highest rate, it is said, ever paid by the city. There is encouragement over the financial situation in the statement that a Morgan syndicate will take $40,000,000 at that figure, probably to place them abroad; but the real significance lies in the price and in the fact that the city had exhausted its credit on any lower basis of return to the investor. It will be something to be spared the spectacle of a great city hawking its bonds among its creditors and humble contractors, at a discount virtually, in place of cash, but the recent episodes have a bright side in the necessary implication that higher rates of interest must act automatically as a check on municipal ownership investment. New York does not stand alone in this impaired financial condition, and as our cities must now pay more for their loans they will be less inclined to plunge headlong into costly and foolish experiments of which the Williamsburg Bridge garbage destructor lighting plant is only a typical example.

Climbing the Alps.

The important announcement is made elsewhere in our pages this week that it is seriously proposed to equip electrically the Sacramento Division of the Southern Pacific Railroad, and that Mr. Frank J. Sprague has been retained as consulting engineer by the Southern and Union Pacific systems, to investigate and report on the project. The attitude of Messrs. Harriman, Kruttschmitt and Babcock is favorable, which means a great deal, but the real obstacles and difficulties are physical and lie in the fact that the task is that of handling electrically the business of a trunk line over an Alpine range of mountains. In this respect the new work differentiates itself sharply from that which has been done, for example, on the New York Central, with its four tracks and absence of grades; and a wholly new set of conditions has to be encountered and overcome. Mr. Sprague has never yet failed in anything he has attempted, his methods of attack are always brilliant, and intense interest will follow him into this latest field of study and effort.

That such a gigantic task should be attempted, with the belief of the owners of the property and its engineers that electricity is adequate, is indeed a most striking sign of the times and of the manner in which, slowly—very slowly, perhaps, but none the less surely—the main lines of railroad in this country are becoming and will be electrified. It is a coincidence of a very impressive nature that we are able, also, to print this week a brief statement of the plans of the authorities of Chicago for the electrification of all the trunk roads entering that city, thus following the worthy example of New York and hastening similar decision in all the other great urban centers of population.

THE INVERTED MANTLE.

The appearance of the Welsbach burner in the inverted form is one of the most interesting recent improvements in the materials of illumination. From Mr. T. J. Litle's Illuminating Engineering Society convention paper we should judge that the earlier difficulties with this form of burner had been in the main overcome, although the thermostatic arrangement still looks a bit shaky to those familiar with such devices. However this may be, the inverted mantle is apparently with us to stay and one can hardly doubt that it will be an important factor in competition between electricity and gas. Viewing the subject broadly, this competition improves business all along the line, and in the long run it is a good thing however annoying it may at times be. The inverted burner is not quite so efficient in total light emitted as the usual form, although it delivers much more useful light. It extends the field of competition by the readiness with which it can be applied in cases to which the ordinary Welsbach is ill fitted. If it can aid in forcing those who deal in electric light into paying a little more attention to domestic lighting and other classes of small consumers, it will in the end prove a capital thing for the electrical business, and will certainly stimulate the improvement of electric lamps and their applications. The inverted burner is extremely well adapted for domestic use on account of its convenient form.

It has, however, the same difficulty that inheres in the whole class of mantle burners, that is, a peculiarly offensive color when the mantle is beyond the first freshness of youth. Of course, it has not the graveyard suggestions of the mercury arc, but it is, to put it mildly, trying to a delicate complexion. From time to time within the last few years we have heard of "our new type Z mantle, that gives a pure white light." We have hunted high and low for that mantle, but it can be located only in the eternal about-to-be. All the mantles which are to be purchased at the mantle-monger's degenerate after a brief period either into the familiar bluish-green or into a singularly evil-looking yellowish-green. There were produced for a few years since some pinkish glass shades which gave rather good results on the Welsbach mantles, but of late either the process of making them has proved too troublesome or the "Type Z" will-o'-the-wisp has proved too alluring, and they have disappeared.

Until the Welsbach contingent succeeds either by improvement in mantles or by other means in correcting the color of the light, the electric lighting interests have small reason to tremble. For one-half of humanity is feminine and that half will not put up with any of the present brands of mantle save under stress of necessity. In this particular the inverted burner merely changes the place and keeps the pain. The time is rapidly coming, however, when the use of mantles on gas systems will become the general rule and when the small mantle burners now common abroad will be brought into use here. A 20-cp burner on a very small gas consumption would put an entirely new phase on existing conditions. It certainly behooves lamp manufacturers to look ahead a bit and busy themselves with the metallic filament lamps, especially for moderate powers. One cannot adhere to the present policy of keeping up the consumption of energy and raising the candle-power, against the competition of cheap gas and burners which do not give twice the light that is necessary.

MAGNETIC STEEL ALLOYS FOR TRANSFORMERS.

Much attention has been devoted in recent years to the improvement of sheet steel for transformers, whereby the losses in hysteresis and eddy currents might be reduced. The outcome of this study has been a marked improvement in the magnetic quality of the steel ordinarily employed, not only in regard to core losses of transformers, when first assembled, but also in regard to the absence of age effect, or increasing loss with time. It seems unlikely that the end of such improvement has yet been reached, seeing how little is yet known about the nature of magnetism in iron, and still less about the influence of other substances on the magnetism of iron alloys. As an evidence of future possibilities in the further reduction of transformer core losses, we have the special alloy-steel that has been produced in Germany, reference to which has already appeared more than once in the Digest. The alloy referred to is a silicon-steel alloy, said to contain about 3 per cent of silicon with very small amounts of carbon, sulphur and phosphorus. This alloy has, according to tests published by R. Pohl, a low hysteretic coefficient, a high resistivity, and a high permeability for flux-densities not exceeding 10 kilogausses. Above that flux-density the permeability falls off rapidly, as compared with ordinary transformer steel. The hysteretic coefficient appears to be about 1.2×10^{-3}, or 40 per cent less than that of ordinarily good transformer steel, while the reluctivity from the tests above quoted is 60 microersteds per unit magnetizing force. The weak point of the alloy is its cost, which is quoted as 150 per cent in excess of that of ordinary transformer steel. It is claimed that even at this extra expense it will pay to use this silicon-steel alloy in the construction of transformers, because of the higher flux-density which may be employed, and the corresponding reduction in the size and weight of the core. The advantage is the greater, the lower the flux-density ordinarily employed. For very large transformers, with cores worked at a relatively high flux-density, there would be no commercial advantage in the use of such an alloy at the above price; but for smaller transformers, employing a relatively low flux-density, an argument may be made for the alloy. According to the tests published in the *Elektrotechnische Zeitschrift* for June 13, the core-loss per pound, at 60 cycles per second, would be about the same at 9 kilogausses with the alloy, as at 6 kilogausses with ordinary steel.

Whatever the economic facts may be, in detail, as to the use of this particular alloy, the general deduction may be drawn that there remains a good field for commercial research in the metallurgy of steel for transformers, either as to finding alloys of better electromagnetic properties, or as to reducing the cost of their production, or as to both. As regards sheet steel for the construction of armature cores, there is not so good a prospect. Any great advantage gained in the production of transformer sheet steel would probably benefit armature sheet steel also, but since it is customary to work armature cores at a much higher flux-density than transformer cores, a good permeability at these high densities is very important. So far as has yet been determined, pure iron has the highest permeability at densities approaching saturation; or to put the matter in another way, the introduction of foreign substances into alloys with iron has thus far been found to reduce the permeability near saturation; although it may not have a bad effect at low flux-densities.

Electric Traction on the Pacific Coast.

The great problems of heavy electric traction on the Atlantic seaboard have barely been solved, or dealt with, before the scene shifts to the far Pacific slope, where questions of equal magnitude loom up and press for settlement. The methods and apparatus for the trunk systems ending in New York are still in the early stages of newness, and one might almost say, uncertainty, when the growing volume of traffic on a road at the other side of the continent compels a serious consideration of the advantages that electricity may offer as a means of doing that which must be done, but which steam appears unable to perform. The Southern Pacific Company, through Vice-President Kruttschnitt, Director of Maintenance and Operation of the Harriman Lines, has, the ELECTRICAL WORLD learns, requested Mr. Frank J. Sprague to associate himself with Mr. A. H. Babcock, the electrical engineer of the company, in a study of all the data bearing upon the question of the feasibility of electrifying a part of the Sacramento Division of the Southern Pacific system, *i. e.*, the section from Rocklin to Sparks; to prepare a general plan of electric traction, and to submit this to a board which is to deal with the subject broadly. Mr. Sprague has also been invited to serve on this board, and it seems that in the event of the adoption of electricity he is to remain with the company as its consulting engineer, without hindrance, however, to any other professional work in which he may be engaged. When interviewed last week as to the truth of the above, Mr. Sprague confirmed it, adding that he was about to assume his duties and was already in consultation with Mr. Babcock.

It will be admitted that this is news of extraordinary importance, and that electric traction in one of its most distinguished representatives has now presented to it a problem which in various respects is more difficult than any of those preceding. The Sacramento Division of the Southern Pacific, running over the Sierra Nevada Mountains, is really a vital link in interocean travel. The enormous growth in trans-continental traffic over the Union Pacific and Southern Pacific, east and west, is far from being realized, although the immense earnings of the system serve as an indication. The road passes over the Sierras at an elevation of 7000 ft., at Summit, on the section between Rocklin on the west slope and Sparks on the eastward one, and all eastbound freight has to be lifted nearly 7000 ft. in a stretch of 83 miles of road. The line is single track, and very tortuous, with frequent grades of 1½ per cent, and a maximum of nearly 2½ per cent. The distance from Rocklin to Sparks across the range is 136 miles, and it is on this section that the enormous grades occur. But these are not the only adverse physical conditions. There are over 31 miles of snowshed and rock tunnel to encounter; and all the ordinary difficulties of summer are aggravated in winter by overwhelming falls of snow.

The present service of traffic, both passenger and freight, is maintained by means of very powerful oil-burning locomotives of the best type extant, with which good results are obtained; but, although the road is kept up to a high degree of efficiency, it is only with difficulty that the traffic is maintained, and at times there is absolute blockade. Moreover, at some periods the traffic is so great that it has already reached the limits of the present capacity of the system. The problem that has been before the management for years is how to increase the capacity—to double track, to build an additional line, or to try a change of motive power. Rebuilding or new building of lines would involve tremendous outlay and delay, and meantime the traffic is growing swiftly, and must be taken care of ad interim. Mr. Harriman, in a memorable interview in the New York *Times* some months ago, expressed openly his conviction that the problem of increased capacity on trunk lines in general would be solved ultimately and satisfactorily by the adoption of electricity.

For some three years past, Mr. Babcock has been devoting his attention to these problems, while the engineers of the great electrical manufacturing companies have also made a special study of the subject. In the selection and appointment of Mr. Sprague, who, as a member of the New York Central Electric Traction Commission for four years, has been largely responsible for that road's terminal equipment; the matter has now taken definite shape, involving a new investigation of the conditions, and a new study of the problem in all its bearings. Mr. Sprague, when seen, said he was not prepared in any way to make a statement on the subject, other than confirm the news of his appointment, which he had accepted. He believed it altogether feasible and possible to operate the division electrically, but as to methods applicable to the unique conditions involved—operating heavy trunk service over Alps—he approached the subject with an open mind, and the best solution of the problem would naturally depend upon the existing or probable development of the art when details were taken up. The first and vital questions were the broad ones whether existing and probable traffic would warrant the cost of an electric equipment, and whether the adoption of electric operation would solve the problem of increase of capacity more satisfactorily than some other method.

Convention of the Ohio Electric Light Association.

The thirteenth annual convention of the Ohio Electric Light Association, held at Toledo, Ohio, Aug. 21 and 22, was the most successful one of this association for many years. The registration went over the 300-mark, and the secretary announced at the close of the convention that only 51 out of 180 central station companies in the state were outside of the association. Eighteen active members were elected at this meeting. The headquarters and sessions were in the new Boody Hotel.

The secretary's and treasurer's report showed total receipts for the year to be $1,107.56 and expenditures $906.01, leaving a balance of $201.55. The souvenir programme issued this year brought in a gross revenue of $1,600 from advertising; of this about $450 was profit, which was used for the entertainment fund instead of asking contributions from manufacturers and central station companies as in previous years. It was voted, at the suggestion of associate members, to increase the dues of associate members—that is, manufacturers and supply companies—from $5 to $10 per year. The secretary's salary was increased from $200 to $350 per year.

The members were taken by electric cars to Toledo Beach Tuesday afternoon, where supper was served by the association. For Wednesday evening the association chartered the steamer *Greyhound* for a trip on Lake Erie. Many ladies were in attendance, as has been usual at Ohio conventions for several years past, and the list of handsome and expensive prizes offered by electrical manufacturers for the winners in ladies' card parties, guessing contests, bowling, etc., was longer than ever, there being 27 such prizes this year. At the close of the convention, Mr. J. C. Martin, chairman of the resolutions committee, presented resolutions, which were unanimously passed, expressing appreciation of the courtesy of the Toledo Railways & Light Company, F. Bissell Company, W. G. Nagel Company, the Toledo Chandelier & Manufacturing Company, Western Gas Fixture Company, and the advertisers in the souvenir programme for their part in making this convention successful.

On Wednesday morning there was an exchange of greetings with the Michigan Electric Association, then in session at Battle Creek, Mich.

The officers elected for the coming year are as follows: President, Mr. Frank M. Tait, of the Dayton Lighting Company; vice-president, Mr. E. H. Beil, superintendent, Youngstown Consolidated Electric Light & Gas Company; secretary, Mr. D. L. Gaskill, president, Greenville Electric Light & Power Company. Executive committee: Messrs. W. P. Engle, Defiance; D. W. Low, Alliance; W. F. Hubbell, Wauseon; J. C. Rothery, East Liverpool.

Following is the constitution of the principal committees: Advisory committee: Messrs. Samuel Scovil, Cleveland; C. R. McKay, Toledo, and D. L. Gaskill, Greenville. Publicity committee: Messrs. W. J. Hanley, of Cleveland; Samuel Rust, Greenville, and J. Kermode, of Cleveland. Finance committee: Messrs. W. E. Miller, Mt. Gilead; T. D. Buckwell, of Toledo, and G. N. Clapp, of Littletown.

Frank M. Tait, president-elect, was born in Catasauqua, Pa., attending the local schools there until 1889 when he graduated from the High School with honors. After a short period of work in the wiring business, he obtained the position of night engineer of the electric light plant in the puddle and bar iron mills of Catasauqua, which was held for over a year, after which employment he became secretary to the president of the Davies & Thomas Company, of Catasauqua, a large producer of cast-iron tunnel rings, underground yoke castings for street railway work, heavy cast-iron structural work, etc. In 1894, the Catasauqua Electric Light & Power Company's plant was

PRES. F. M. TAIT.

placed in his charge as manager to rehabilitate and bring up to a paying basis, and after a number of years of hard work this was accomplished. In the meantime, the Catasauqua Gas Company was purchased and merged with the electric company into the Catasauqua Gas & Electric Company, which he directed until early in 1899, when he associated himself with the Somerville (N. J.) Gas & Electric properties, and rebuilt and rearranged the steam, water power and gas plants into a merged concern known as the Somerset Lighting Company, which supplied all of the gas and electricity used in Raritan, Somerville, Finderne, N. J., and all the gas in Bound Brook, N. J. This company is now a part of the Public Service Corporation of New Jersey.

In 1902, Mr. Tait became identified with the New London, Conn., properties, and the gas and electric plants, as well as a first-class general machine shop, were developed into a company well known in New England as the New London Gas & Electric Company. Jan. 15, 1905, he became interested in the Dayton Electric Light Company, and since that time has been engaged as manager in waging a vigorous campaign for upbuilding and thoroughly modernizing the company, now known as the Dayton Lighting Company. For rapidity of development in a city occupied for years by a lighting company, the work at Dayton has no parallel. Mr. Tait, besides managing the Dayton Lighting Company, is frequently called on to examine and report on gas and electrical properties, particularly those requiring the pointing out of correct methods of producing quickly the profitable results desired by the financial interests that control them.

The meeting was opened on Tuesday morning by the address of President W. P. Engel, of Defiance, Ohio. In referring to the importance of the association, he pointed out that Ohio has about 180 central stations, representing an investment of $70,000,000. While in the early days the problems coming up in the central station were purely mechanical and electrical, the industry has moved forward so rapidly along these lines that it has nearly reached the ideal. While continuing to give due regard to engineering problems, to-day every management places stress on the commercial development, and rightly so, as it is the source of revenue and in the highest sense affects the relations of the new central station with the general public. After paying a compliment to Mr. J. Robert Crouse and the Co-operative Electrical Development Association, President Engel directed attention to the work of the National Electric Light Association as to uniform specifications for street lighting, and suggested that steps be taken by the Ohio Association to inform its members as to the methods most satisfactory to the public and to the central station with respect to specifications for street lighting and plans for charging for electricity. Public opinion should, he said, be carefully studied and the central station management should all be ready to meet it courteously. Central station men are able personally, and with the aid of subordinates, to make public opinion favorable or unfavorable, what is sown will be reaped.

Following the address of President W. P. Engle, papers on "Factory Lighting" were read by Mr. A. P. Biggs, of the Edison Illuminating Company, of Detroit, and by Mr. J. Kermode, of the Cleveland Electric Illuminating Company, abstracts of which appear below. Tuesday afternoon, Mr. H. P. Grabill, of Ashland, Ohio, presented his paper on "Luminous Arcs From the Standpoint of the Central Station," which is abstracted elsewhere.

The "Report of the Committee on Electric Heating Devices," by Mr. M. E. Turner, of Cleveland, was presented, but the author was prevented by illness from being at the convention. Mr. F. M. Tait presented the subject of "Co-operative Commercialism in the Electrical Field," acting on behalf of Mr. J. Robert Crouse, of the Co-operative Electric Development Association. The final paper of the session was that of Prof. F. C. Caldwell, of Ohio State University, which is reprinted elsewhere, on the "Best Form of Power for Stations of 500 Kilowatts Capacity or Less."

On Wednesday afternoon the committee report on "High-Efficiency Lighting Units," by Mr. C. C. Collins, superintendent of the Columbus Railway & Light Company, and Mr. A. N. Cope, superintendent of the Columbus Public Service Company, were submitted. An abstract will be found below. Under the head of "Helps to a Solicitor," two papers were taken up, one by Mr. A. S. Miller, of the Dayton Lighting Company, on "What 50 Cents' Worth of Electricity Will Do"; the other by Mr. J. D. Kenyon, vice-president of the Sheldon School, Chicago, on "Scientific Salesmanship." Abstracts of these follow.

The final session was held Thursday morning and was given mainly to the subject of "The Best Ways to Meet Gas and Gasoline Competition." Papers on this subject, abstracted below, were presented by F. H. Golding, of the Dayton Lighting Company; Samuel Rust, of the Greenville Electric Light & Power Company; W. E. Russell, of the Massilon Light, Heat & Power Company; Arthur Pomeroy, of the Cleveland Illuminating Company; E. T. Selig, of the Mt. Vernon Electric Light Company, and W. C. Anderson, of the Canton Light, Heat & Power Company, the latter being read by the secretary in the absence of the author.

FACTORY LIGHTING.

In his paper on factory lighting, Mr. A. T. Biggs stated that an electric lighting company cannot afford to take on all factory lighting offered to it. It is compelled, however, to take a certain amount that is inherently unprofitable. The unprofitable lighting should be minimized (1) by advising the customer how to reduce his demand by utilizing light to best advantage; that is to say, by good illuminating engineering; (2) by advocating the transfer to daylight hours any motor load that may be dispensed with during the evening hours, and (3) by passing over to the gas company such factory space light-

ing as can be profitably furnished by gas arc lamps, retaining for electricity the long-hour localized lighting.

The paper by Mr. J. T. Kermode brought out the fact that industrial plants can be lighted by electricity in a satisfactory manner and at an expense that would compare favorably with any other source of illumination, provided the equipments consist of high-efficiency units installed according to modern practice. Mr. Kermode stated that electricity supply companies should devote more time to the practical demonstration of the benefits to be derived from the use of high-efficiency units, with the idea of introducing a more intelligent mode of factory lighting as a valuable factor in securing and retaining motor business.

PROGRESS IN HIGH-EFFICIENCY LIGHTING UNITS.

Messrs. C. C. Collins and A. N. Cook presented a paper with the above title, giving the results of a canvass of central stations as to their experience with high-efficiency illuminants. A form containing 22 questions was sent out to 65 central stations, and the authors confess that the response was unsatisfactory, both as to number of replies and information communicated. Of the 19 companies heard from, five had experience with the flaming-arc lamp, but only to a limited extent, the total capacity in use being only 38 kilowatts. The magnetite arc lamp is used by two companies, to whom it is giving satisfaction. The Cooper Hewitt lamp is used by five companies, in photograph galleries, printing offices and machine shops. Twelve companies are using the Gem lamp, the total kilowatt capacity connected by 11 companies being 834, nearly 90 per cent of which is in lamps of 100 watts or more. Two companies are using the tantalum lamp and one company has adopted the tungsten lamp in order to meet competition. Eleven of the companies are using the Nernst lamp, 1334 kilowatts being connected, the average number of glowers per lamp being three. The replies to one question indicated a life for the magnetite lamp of 500 to 600 hours. and for the Nernst lamp 600 to 700 hours. Answers to another question show that the units are generally put on the lines at cost and free renewals given. Nernst lamps are, in some cases, loaned, but this is found to run up a very large investment. The cost of renewals per kw-hour was returned as one-half cent for the Gem and Nernst lamp; the authors state that this is not high as compared with the carbon filament lamp. Every company replying stated that an increase in revenue has followed the introduction of high-efficiency units.

HELPS TO A SOLICITOR.

In his paper on "Helps to a Solicitor," Mr. A. S. Miller showed that with 50 cents' worth of electricity an ordinary stable can be lighted with three 16-cp lamps for one month; it will do the washing eight times for an ordinary house; it will pay for the energy consumed in two weeks' ironing; it will operate a drying fan for one month; it will serve for operating a sewing machine for two weeks; it will operate a porch lamp for two months; it will pay for the energy consumed in a hot-water bottle three hours per night for 30 nights. In operating a hoist, 50 cents' worth of electricity will raise 2,000,000 bricks for the ordinary house. Information of the above character is of great value to a solicitor.

The paper by Mr. J. D. Kenyon showed that that solicitor is best equipped for his business who has received the training of a scientific salesman. Such a salesman must not trust to natural conditions or to the natural development which will come from ordinary contact with the world, but he must be a trained man in order to meet successfully the strenuous competition of modern times. The scientific salesman should have an accurate knowledge of types, temperaments, motives and habits of people, in addition to a detailed knowledge of his business.

MEETING GAS AND GASOLINE COMPETITION.

Six papers were presented on the common subject of the best way to meet gas and gasoline competition. Mr. Samuel Rust suggested the following ways: Good service; prompt attention to complaints; maintaining friendly relations with the non-user of electricity; making of frequent calls and talks on methods of electric lighting; furnishing the best appliances for the customer's use, and reducing the cost of his lighting as much as is possible, consistent with good service. Mr. W. C. Anderson suggested the following ways: Making the rates for the long-hour user in proportion to the cost of long-hour service; developing decorative lighting to the fullest extent to which this can be developed; giving the customer the greatest possible amount of useful light for the smallest possible cost for electricity and maintenance. Mr. Arthur Pomeroy showed that an electric motor can be substituted for a gas engine with considerable economy, while the comparative noiseless operation of a motor and its perfect cleanliness are greatly in its favor. Mr. W. E. Russell called attention to the great credit due to the electric flat-iron for its effectiveness in giving a favorable impression of electric service. He emphasized the fire hazard of gas in any form. Mr. F. H. Golding showed that the most serious obstacle met with in gas competition is the expense of installing the electrical equipment. Plans for making the installation at the minimum cost and for allowing the customer to pay for the equipment in monthly instalments were outlined. Mr. E. T. Selig related the experience of the electric lighting company at Mt. Vernon, Ohio, where natural gas is sold at 13.5 cents per 1000 cu. ft. Such competition has been met by a system of free renewals of lamps, and improved service. By newspaper advertising users were shown that except in rare cases where a lamp might be broken, the customer's only cost for lighting was his electricity bill, while in some instances the cost of gas, together with the mantle and chimney renewals, amounted to more than the cost of the electric lighting. Many people who are attracted first by the cheap gas, soon become dissatisfied with it as a source of light and turn to electric lighting, although continuing to use gas for heating purposes.

Michigan Electric Association Convention.

The Michigan Electric Association held its fourth annual convention at Battle Creek, Mich., on Aug. 20, 21 and 22. The headquarters were at the Post Tavern, and the convention sessions were held at the very comfortable rooms of the Battle Creek Business Men's Association in the Post Building, across the street from the hotel. About 25 central station and municipal plant representatives were in attendance, besides about an equal number of supply men.

The sessions were presided over by Mr. William Chandler, of Sault Ste. Marie, president. He called the first session to order about 11 a. m., Aug. 20, and introduced Mayor C. C. Green, of Battle Creek, to welcome the convention. President Chandler, in his presidential address, called attention to the bad effect on the central station business of having interior wiring done by irresponsible parties. He thought the convention might well give consideration to the question of whether the proposed legislation requiring electric wiremen to be licensed might not be a good thing, and also whether the encouragement of more municipal inspection and regulation was desirable.

The report of Mr. E. F. Phillips, of Detroit, chairman of the committee on fire insurance, was heard. It contained some astonishing figures on the overcharges by insurance companies on electric light station risks. Among the companies from which figures had been obtained, about $59,000 had been paid in premiums the past five years, with about $4,000 losses. There was considerable discrepancy and inconsistency in the rates charged different companies reporting to the committee. Mr. Phillips suggested mutual insurance as one way out of the difficulty. This insurance question was discussed at length at the following afternoon session. It was brought out in the discussion that in many instances considerable reduction in insurance was possible by small changes. Insurance companies, however, take no pains to let customers know about such possible changes, and their effect on the rates. In fact, it was against the immediate financial interest of agents to reduce risks and

lower rates, as it meant decrease in their commissions, which are a percentage of premiums. The insurance committee was continued for another year.

Mr. F. E. Greenman, of Grand Rapids, read a short paper on "A Year's Operation at the Highest Working Voltage in the World, by the Grand Rapids-Muskegon Power Company." The 72,000-volt line of this company was briefly described, together with operating experiences. A part of this paper and the interesting discussion following it will appear in a later issue.

President Chandler opened the Wednesday morning session with a talk on "Experience With Tungsten Lamps at Sault Ste. Marie." After talking over with Mr. Alex. Dow, of Detroit, the question of the form of tungsten lamp which was most desirable for central station companies for the immediate future, they decided that something which would compete with gas arcs was the most desirable. A fixture was devised which would take four 28-volt, 25-watt tungsten lamps in series, on a 112-volt circuit. The first fixture had the lamps placed upright, but they had decided later that it would be better to use the lamp in a pendant position. Five stores are now lighted with series lamps. None of these series lamps had been broken in shipment. In one store, the series lamps had been burned singly in different locations. This plan involved a little more trouble and more expensive special wiring. Among these series lamps there had been no burn-outs due to defective filaments, but some to defective anchors. He did not think that the tungsten lamp would reduce central-station incomes, as he said customers would use more light than before and spend the same amount of money.

Mr. George C. Osborne, of the General Electric Company, addressed the convention on tungsten and tantalum lamps. The tungsten lamps now available, he said, are the street series lamps of 40 and 60 candle-power, designed to burn on 5.5, 6.6 and 7.5-ampere circuits, and also some for 4-ampere circuits to go in series with magnetite arc lamps. There is also on the market at the present time a 25-watt, 28-volt lamp, intended to burn four in series on ordinary incandescent circuits, as described by Mr. Chandler. These series lamps have a left-hand thread on the base, designed to screw into a special left-handed thread socket, so that they can not be accidentally screwed into common 110-volt sockets and the lamp destroyed. As to the series tungsten lamps, a trial 75-light circuit had been in commercial service 1800 hours and 30 per cent of the lamps were still burning, giving the same candle-power as in the beginning, but with some increase in wattage. Of those which had been replaced, 25 per cent had been broken by boys throwing stones. With the 110-volt tungsten lamps, the great trouble had been breakage in shipment. There had, however, been much improvement in this respect.

Taking up the tantalum lamp, he said that the policy of some central stations in giving them to the user at an extra cost of 30 to 50 cents per lamp discouraged the user from making use of them, as very few would pay the extra price. A new proposition was advanced for the handling of tantalum lamps, namely, that these lamps be rented to long-hour users at 5 cents per lamp per month instead of charging 30 cents or more per lamp. This would take care of the higher renewal cost of the tantalum lamp. Another plan suggested was to make a higher rate per kw-hour to users having complete tantalum installations, the central station company to furnish the renewals.

In the discussion which followed, inquiry was made as to whether some recent claims that the tantalum lamp had a satisfactory life on alternating current were valid. Mr. Osborne replied that the 44-watt tantalum lamp was of uncertain length of life on alternating current. Some lamps would make a very good showing and others would not. The 80-watt tantalum lamp, however, had given a life of over 500 hours on alternating current abroad, and it was reasonable to expect that eventually it would do as well here.

Mr. Chandler said that at Sault Ste. Marie the four-light series fixtures mentioned by him had been either sold to the customer or rented at 50 cents per month, the 50 cents per month being the same charge as was made by the gas company for the rental of "gas arc" lamps.

Mr. E. A. Harris, of the Westinghouse Electric & Manufacturing Company, read a paper on "Prepayment Meters" in general and the construction of the Westinghouse prepayment meter in particular. Mr. Harris stated that the prepayment meter appealed to the class of people used to handling small quantities of money and to spending a little at a time, as they go along. For the central station this meter had the advantage of reducing the cost of collecting bills and keeping accounts. These meters could be adjusted for different rates per kw-hour, so that when installed on the premises of a long-hour consumer, he could be given the benefit of one rate. They could also be used for electric cooking circuits, where the customer wanted to know his costs. For store window lighting it could be used as a time switch. Their cost is now only about 15 per cent higher than a common meter of the same capacity.

In the discussion which followed it was pointed out that the two-rate system could not be used with such meters. Mr. A. C. Marshall, of Port Huron, nevertheless thought that there was a good field for them in spite of this drawback. He found many customers actually wanted a prepayment meter, so that they would know how their costs were running, even though they lost the benefit of the differential rate.

Mr. E. F. Phillips, of Detroit, said that this loss of the discount of the two-rate system was no objection to the prepayment meter, even in cities where the two-rate or differential rate was in use. At the present low price there was a good field for them. Such meters had been too costly in the past to make them feasible. Mr. B. J. Denman, of Detroit, thought that the cost of keeping a customer's account would not be reduced, as there would be a customer's account and a collector would have to be sent after the coins, whereas ordinary customers come to the office to pay. Mr. John A. Cavanaugh, of Benton Harbor, said that they kept no accounts with prepayment-meter customers; it was simply a question of going and getting the money. President Chandler pointed out that some customers in small towns do not come to the office, and it is almost impossible to enforce the cash discount plan in small towns. Mr. Marshall suggested that where tenants changed frequently, prepayment meters could be left on the premises and save the cost of connection and disconnection. Very often the incoming tenant would use electric light if the prepayment meter was already installed ready for business, where otherwise he would not.

Wednesday afternoon, Mr. J. B. Foote, of Jackson, gave some experiences with the magnetite street arc lamp at Jackson. Three hundred of these lamps were put on the streets of Jackson three years ago. At first there was considerable globe breakage, due to the splattering from one of the electrodes. This had been rectified by the use of a solid copper electrode block, and now the globe breakage is no greater than on the other arc lamps operated by the company. The cost of electrodes, including magnetite sticks and copper blocks, is a little less than the cost of carbons for the enclosed arc lamp. The lamp burns about the same time between trimming as the enclosed arc. The lamp used takes 320 watts for four amperes, as against 525 for the lamps displaced. It was found that owing to the distribution of the light, a given size of type could be read twice the distance from the magnetite arc than it could from the 525-watt carbon lamp. He thought that future installations of street lamps made by his company would be of this type.

Mr. A. P. Biggs, of Detroit, read a paper on "Factory Lighting," which was also presented before the Ohio Electric Light Association the same week. Supplementing this a paper by Mr. J. Kermode, of Cleveland, on the same subject, presented before the Ohio association the day before, was also read. Mr. Biggs' paper, in which the practice was advocated of recommending the use of "gas arcs" for the general lighting of a factory in order to keep down the maximum demand of the factory, resulted in a long and animated discussion, the policy being attacked by many central-station men and defended by

those from Detroit, where this policy originated. An abstract of this discussion will appear in a later issue.

Thursday was largely taken up with informal discussion of results of new business campaigns in various cities, which will appear in a later issue. The following officers were elected: President, Mr. H. W. Hillman, manager, commercial department, Grand Rapids-Muskegon Power Company, Grand Rapids, Mich.; vice-president, Mr. J. A. Cavanaugh, superintendent, Benton Harbor-St. Joseph Railway & Light Company, Benton Harbor, Mich.; secretary and treasurer, Mr. A. C. Marshall, general manager, Port Huron Light & Power Company, Port Huron, Mich. Executive committee: Messrs. L. B. Schneider, Tecumseh; D. D. Dodge, Lansing, and A. J. Noble, Albion.

The entertainment features were well taken care of by Messrs. A. H. Mott, W. P. Stephens and Daniel H. Beardslee. The entertainment committee was backed by the Commonwealth Power Company and the Citizens' Electric Company. A theater party was given at the Bijou Theater on Tuesday evening, and after the session Wednesday special cars were taken to Gull Lake, where boating and fishing were enjoyed, followed by a dinner at the Allendale Hotel. The ladies were entertained during the convention sessions by various trips to points of interest.

CURRENT NEWS AND NOTES.

ELECTRICAL ENGINEERING GRADUATES AT SCHENECTADY.—The General Electric Company has taken on at its Schenectady works 248 of this year's graduates from electrical engineering courses.

PATENT OFFICE EXAMINERS.—The U. S. Civil Service Commission will hold examinations Oct. 16 and 17 for assistant examiners in the Patent Office at an entrance salary of $1,200 per annum. Forms of application, etc., can be obtained from the commission in Washington. The age limit is 20, and the examination is open to all citizens of the United States.

WHAT STRIKES INVOLVE is shown to some extent by the report of the Bureau of Labor and Commerce. It appears that from 1881 to 1895, inclusive, there were 36,757 strikes in the United States, 69 per cent of which were ordered by labor organizations. The strikers numbered, all told, 6,720,048, but as other workmen dependent upon them were forced into idleness, the real number thrown out of employment was approximately more than 9,500,000. The average duration of the strikes was 25 days. At one dollar per day, this would seem to involve a loss in earnings of about $250,000,000.

MUST RESUME SERVICE.—At Helena, Mont., on Aug. 8, Judge Bach, in the district court, issued a writ of mandamus to compel the Rocky Mountain Bell Telephone Company, whose operators are on strike, to resume operations. He declared that service must be resumed or the franchise would be forfeited. He said he would punish any one who attempts to interfere with the lines, but the mere fact that one person persuades another not to work and uses no threats or force does not justify the company in refusing to do its duty to the public. Judge Bach said he knew the company could get all the assistance needed if sufficient remuneration were held out.

MONTREAL EXPOSITION.—With regard to the coming exposition in Montreal, Mr. R. S. Kelsch writes us as follows, in regard to additional events: "We have received word that the Maritime Province Electrical Association will leave Halifax Sept. 7, and arrive in Montreal on the evening of Sept. 8, and open its convention in the Windsor Hotel, Montreal, Sept. 9, so that, during the week of Sept. 9 to 14, we expect to have about the liveliest time in Montreal that we have had in several years. The 'Sons of Jove' will also have an annual meeting in Montreal during the same week, so that with the two electric light associations, the street railway association, the Sons of Jove meeting, the fall meeting of the Montreal Jockey Club, etc., we expect to be extremely busy."

WIRELESS ON MOTOR YACHT.—The first motor yacht to be installed with "wireless" is the *Sea Otter* of the New York Yacht Club fleet, owned by Hugh L. Willoughby, of Newport, R. I. The Massie system which is used is installed in a very compact manner, one of the small cupboards being utilized for the purpose. Although the aerial is only 40 ft. in height, Mr. Willoughby, who has made a study of the art of wireless telegraphy and operates the apparatus himself, can easily read the Nantucket Shoal lightship from Newport Harbor, a distance of over 100 miles. The *Sea Otter* is 60 ft. long, with a beam of 10 ft. 4 ins.; engine is of 125 horse-power, a six-cylinder Standard motor. When running, a small dynamo is belted to the engine, current from which is used to charge storage cells, which in turn supply power for lights and fans, as well as the wireless outfit.

THE TELEGRAPH STRIKE continues with no apparent change in the situation. In general, the striking operators have been very well behaved, although frequent malicious interruptions and cutting of circuits are reported. In Ohio, the lines between La Carne and Camp Perry are being patrolled by U. S. infantry to stop the interference with the wires. The companies speak confidently and positively as to their ability to handle business and claim to have minimized delay. President Small, of the Commercial Telegraphers' Union, has been visiting New York, and attended a meeting, at which Mrs. Rose Pastor Stokes indulged in some socialistic talk. Commenting on this Superintendent Brooks, of the Western Union, remarks: "I understand that Mrs. Stokes is an estimable woman, and takes a charitable interest in the working people on the East side. I understand that she worked once in a cigar factory, but that would not qualify her to be an expert in telegraphy. She says that the strikers in asking 15 per cent advance in wages ask for too little, and that the companies could afford to pay more. As a matter of fact she has no way of knowing anything about it. The operators are well paid and the company could not afford higher wages."

LIGHTING IN EUROPE.—In a long article on an interview with Mr. H. L. Doherty, and some of his work in this country, the London *Gas World* says: "There is at least one American gas engineer in this country this summer, and though he is here mainly for rest he has been looking around and taking notes. And one of these notes is not particularly flattering to us. He has not been favorably impressed with any of the show pieces of street lighting that we are sometimes inclined to boast about. The only consolation is that the faint praise he bestows upon English lighting is also extended to the lighting of Paris, to which we have been accustomed to turn for an example of how such work should be done. It is not so much the quality of the actual street lighting that our visitor is disappointed with as the little aid it derives from the outside lighting of shops and other premises. In the United States it is the practice of business people to light the exterior of their premises on a very lavish scale—the whole building being often outlined in points of light—and it is the general absence of this sort of thing in London and in Paris that has surprised our visitor. 'I could take you,' he remarked, 'to a little town in the wilds of Nebraska which is a perfect blaze of light.' 'I have seen nothing like it in my travels here,' he continued, 'and I only mention this town as an instance of the general practice in practically all the towns of the United States.' The street lighting of Paris, he admitted, is very pretty—so far as it goes—but there is not enough of it to satisfy the eye of the man accustomed to American lavishness in this regard; and the gloom of the buildings both there and in London is a continual wonder to him."

SIBERIAN WIRELESS.—It is stated from Berlin that Japan and Russia are planning the establishment of wireless connection with Siberia. Japan is connecting Vladivostok and Tsuruga, on the west side of the Island of Hondo. It is proposed to lay the plans before the various Chambers of Commerce interested and also before the International Telegraphic Conference next April for indorsement.

LIVELY LIVE WIRE.—On the ground that she was almost completely disrobed by a live wire, Mrs. Maud S. Orr, prominent in Atlanta, has sued the Georgia Railway & Electric Company for $10,000 damages. Mrs. Orr was shopping on a street in Atlanta when the broken end of a guy wire which had been charged in some way, touched her feet. The current tore her belt off and also other portions of her attire until she stood almost completely nude in the crowded street.

ELECTRICAL ENGINEERING AT THE U. S. NAVAL ACADEMY.—The electrical course at the U. S. Naval Academy is being reorganized with a view to rendering it more practical in nature than in the past. To this end greater attention will be paid to practical work in the laboratory and to the actual handling, assembling and care of dynamos, motors, etc. The class-room instruction in electrical engineering will be confined to the two upper classes, which will have completed during their first two years the necessary preliminary studies in physics and mechanics. The course will be in charge of Lieut.-Com. W. H. G. Bullard, U. S. Navy.

MME. CURIE AND RADIUM.—A special cable dispatch from Paris, of Aug. 24, says: "Mme. Curie has communicated the results of her latest researches to the Academy of Science in a paper treating of the atomic weight of radium. With characteristic diffidence she refrains from absolute conclusions and merely puts the weight at 225, subject to further researches. Mme. Curie's paper, which is of a highly technical nature, will appear in the next issue of the academy's official publication. When asked what she thought of Sir William Ramsay's announcement of the transmutation of copper into lithium, Mme. Curie replied: 'I am not sufficiently acquainted with the effects of radium on metals to be able to give an opinion of any value. I agree, however, that the discovery will have important results if confirmed.'"

METER TESTING has already been taken up by the New York Public Service Commission of the first district, and now it is stated that various authorities are to appear this week before the Utilities Board of the second district in Albany to give expert opinion as to the testing of electric meters, which will be undertaken shortly by the board, in accordance with the provisions of the Utilities law. In an official circular, which has just been issued, the new commissioners have invited representatives of electric lighting companies in the state to meet them for an exchange of views on the subject. Representing the principal lighting companies of the state, the Empire State Gas & Electric Association is making an effort to furnish expert opinion and data to the commissioners at the Albany meeting.

IMPROVING SIGNAL SERVICE.—Advices from Washington state that Brig.-Gen. James Allen, chief signal officer of the army, in his annual report urges a strengthening of the arm of the service in his charge. He says that it is now recognized by military authorities that the strength of an army is not alone measured by the number of men it contains, but by the number rifles, guns and sabres it can put into cooperatively effective action at any one time. Although the late Russo-Japanese conflict furnished an example of the use of this "military weapon" in advance of anything previously attempted, yet it is believed that by the development of the power of accurate control upon the field of battle through perfect lines of information it would be possible for the commander who first utilizes it to the limit for tactical purposes to gain decisive victories. Gen. Allen points with regret to his inadequate forces, saying that there is a shortage both in officers and men throughout the service and submits a scheme for a general increase in the corps so as to have 1500 privates and a proportionate number of officers obtained in part by detail from the line.

STEAM LOCOMOTIVES IN CHICAGO.—As a first step in an investigation of the advisability of electrifying the Chicago terminal lines of the 23 trunk railroads entering that city, Mayor F. A. Busse and a party of Chicago officials arrived in this city last week and made an exhaustive examination of the newly electrified lines of the New York Central. In the party with Mayor Busse were Dr. W. A. Evans, health commissioner; Walter H. Wilson, controller; Milton H. Foreman, chairman of the aldermanic committee on local transportation; John M. Glen, secretary of the Illinois Manufacturers' Association, and J. E. Donnelly, chairman of the Chicago Smoke Commission. Almost an entire day was spent in the examination of the electric system. Vice-President W. J. Wilgus showed the men through the power houses and over the line. At the earnest solicitation of Mayor Busse and the others in the party, Mr. Wilgus has consented to go to Chicago and look over the situation there. He severs his connection with the New York Central on Oct. 1, and will go to Chicago then. It is very probable that if the electrification of the Chicago roads is taken up, Mr. Wilgus will be associated with the work.

OVERHEAD WIRES.—A bill is to be presented to the next New York Legislature, giving the necessary power to electors in the different boroughs of Greater New York to vote for the burial of all electric light, power, telephone and telegraph wires, within the next five years. The Tree Planting Association, of which Col. C. B. Mitchell is the head; the American Scenic and Historic Preservation Society, and the American Civic Association, as well as many organizations in the Borough of Queens, have taken up the matter energetically, all the more so since, it is alleged, in the wake of their agents have followed corporation canvassers who have promised citizens that the companies using wires will make such changes as will render the passage of the bill unnecessary. The bill provides that the work shall be done at the expense of the companies, which, it is argued, should defray the cost. A principal feature of the bill is that at the next general election the electors in each borough shall vote on the question whether the wires shall be buried, and if a majority are favorable, then the work shall be done. There is a provision that if a vote is not favorable it shall be repeated every second year for three times.

WIRELESS ON PACIFIC.—Arrangements have been completed whereby the war and navy departments will co-operate in the maintenance of wireless communication between Nome, St. Michael, Seattle and San Francisco. The signal corps of the army already has wireless stations at Nome and St. Michael, and next year will establish a station at Fort Gibbon. The latter station will be capable of communication with the navy wireless station to be erected at Valdez. The navy already has stations at Sitka and 800 miles from Valdez, at Tatoosh Island, about 100 miles from Sitka, and at North Head, Table Bluff and Cape Blanco. The distance between the three latter stations varies from 175 to 300 miles. Stations are to be established by the army this fall at Fairbanks and Circle City, and a land line is to be built from Tacoma to McCurdy. The war and navy departments have suffered considerable inconvenience since the telegraphers' strike began and the utility of the wireless is becoming better appreciated. The army cable-ship Burnside is now in Alaskan waters making cable repairs. The cable between Sitka and Valdez may be diverted to Montague Island and pieces spliced in at that place at Katalla, which may become a railroad terminus.

CANADIAN LABOR.—The number of wage-earners employed in making electrical apparatus in Canada in 1905 was 4806, according to recent returns, with wages of $2,489, 905. Those employed in electric light and power plants were 2418, with wages of $1,460,418.

PUBLIC SERVICE COMMISSION.—There is a popular impression that the offices of the New York Public Service Commission are required to be open all the time, and the office hours are set forth as from 8 a. m. until 11 p. m. But the commission is not living up to its initial high ideals, if we may believe the *Evening Post,* but closes its office and goes off fishing—just like Tammany heelers and other municipal servants.

A SOFT ANSWER.—The following from the New York *Times* might well be put in every telephone girl's pay envelope or hung up in the rest parlors of the exchange: "An excellent thing in woman is a low voice, says the greatest of poets. An instrument to influence the fate of empires is a woman's voice, low of tone, well modulated, used with discretion. Such a voice, it seems, is possessed by a young woman of Blue Island, Ill., who earned her living as a telephone operator. One day lately a Chicago young man addressed harsh words to her over the wire, touching a delayed communication. Her well-considered reply was so charmingly delivered that he fell in love with her voice, and they are now married."

TELEPHONY FOR BROKERS.—A private telephone system to connect the offices of the various members of the St Louis Merchants' Exchange with the main floor is to be installed immediately. Each broker's office, whether in the Exchange Building or in neighboring buildings, will be connected directly with a private telephone booth on the floor. On the wall, in full view of the brokers, will be a large indicator board. At present, when the office wants to call its representative on the floor, it is necessary to call the exchange and send a messenger on to the floor for the broker. With the new system the man in the office will merely lift the receiver from its hook, which will cause the proper signal to be given on the indicator board and the broker steps into his booth and enters into conversation with the office. The New York Stock Exchange has practically the same system now in use.

PLANT FOR LEPER COLONY.—The leper settlement on the island of Molokai, H. I., is to be lighted by electricity within a few months. In the mountains back of the settlement there is an abundant supply of water. It has long been piped down for a water supply and for irrigation. A larger pipe line is now to be put in, which will bring down a supply for power as well as for other purposes. A head of about 400 ft. is available for power, with a reservoir high enough to force water to every part of the settlement and give adequate force for fire protection. It is expected to install incandescent lamps in every house in the settlement and arc lamps along the principal streets. In addition there will be electric power for the poi factory, the laundry and the ice and refrigerator works. Dr. Walter Brinckerhoff has charge of the United States Leprosy Experiment Station soon to be established at the leper settlement on Molokai.

STANDARD WIRING SYMBOLS.—The National Electrical Contractors' Association has just reissued the standard symbols for wiring plans as adopted by the association, the American Institute of Architects of the United States, the Supervising Architect's office, U. S. Quartermaster-General's office, United States Army, several municipal departments, many technical institutions, prominent architects and engineers and numerous individuals. Since the first edition was sent out there has been a change in the symbols for center and bracket outlets, and symbols for indicating gas only outlets have been added. Under the heading "Suggestions," standard heights of wall outlets have been enumerated. These changes and additions were made at the instance of the American Institute of Architects. Copies in the shape of wall-hangers and specification sheets can be had at low rates from the secretary of the association, Utica, N. Y.

THE CODE OF ETHICS.—In its September issue, the *Century* has the following comment: "One of the most gratifying incidents of the present era of ethical awakening in America was the recent agitation in favor of the adoption of an ethical code by the Institute of Electrical Engineers. It is true that at the recent annual meeting at Niagara the carefully prepared code, upon which a competent committee had unanimously agreed, met with delay, on mere grounds of technical procedure. The postponement of consideration by no means, however, implies rejection of the measure, and the present authorities of the Institute will doubtless carry the matter forward with all constitutional dispatch; for no member of this honorable profession, a profession yearly increasing in responsibility and importance, would be willing to go on record as permanently opposing so desirable a reform, and one which the press of the country hailed with such cordial and significant approval."

SIGNS IN BRAZIL.—U. S. Consul-General G. E. Anderson, of Rio de Janeiro, Brazil, sends some interesting information as to outdoor advertising in Brazil where generally all advertising is taxed. He says: "In the way of electric signs there is practically nothing to be seen in most Brazilian cities. I do not know of a single electric sign in Rio de Janeiro, but it is probable that as soon as the new electric light and power service is effective there will be a change and that regulations will be modified to meet changed conditions. In Sao Paulo, in some respects the most up-to-date city in Brazil, there is plenty of electrical energy to be had at comparatively low rates, and electric signs are commencing to appear, but apparently they are employed only in connection with daylight signs and are taxed at the same rate. The effect of taxation in this particular line is unquestionably beneficial from the standpoint of the general appearance of the city, not to mention revenue possibilities. There have been extensive and costly modern improvements made in Rio de Janeiro in the past four years, and the beauty of the city is the subject of never-ending favorable comment from visitors."

MUNICIPAL OWNERSHIP.—The American Street & Interurban Railway Association is making a committee inquiry into municipal ownership again this year. Its circular says: "At the 1906 convention of the association, held at Columbus, Ohio, a committee presented a report on the subject of municipal ownership. The officers of the association have seen fit to continue the same committee for this year, and have asked that another report on the same subject be presented at the convention to be held in October next. It has been deemed unnecessary in the making of this report to discuss to any great extent the question from an academic point of view. The literature on this subject has been so multiplied during the past year by the publication of the results of investigators of social economics, and by the reports of various committees who have made investigation of it, that the members of the association are undoubtedly quite familiar with the arguments for and against municipal socialism in any form, and especially as it would affect the interests of our particular industry. It does, however, seem desirable that the report should cover any progress made either for or against the movement in our respective fields, as well as some statement in regard to general conditions here and abroad, and to this end we are enclosing you a sheet covering a few questions designed to ascertain the condition of affairs with respect to municipal ownership in your immediate vicinity."

Kern River No. 1 Power Plant of the Edison Electric Company, Los Angeles—IV.

TOWERS.

THE transmission line is carried on galvanized steel towers, there being 1140 of these towers. The tower heights range from 30 ft. to 60 ft. They are uniformly constructed of galvanized angle iron, bolted with galvanized bolts and held in shape by means of tension rods. There are no compressive braces except one pair in the upper portions of the sides, and between the cross-arms. The nine insulators are spaced on 6 ft. centers, five on the upper arm and four on the lower, the arms consisting of 9-in. 13¼-lb. channels.

All portions of the tower are figured to be safe under a wind pressure of 30 lbs. per square foot on the tower and the wire of a 700-ft. span. The towers will also withstand absolute failure of any single wire, even though none of the resulting strain is transmitted to adjacent wires.

Fig. 31 illustrates the construction of a standard 60-ft. tower, which is 12 ft. wide and 12 ft. across at the base. The uprights are formed of 4-in. angles and the cross braces of 2¾-in., 3-in. and 3½-in. angles, the diagonal rods being 11/16 in. and ⅝ in. in diameter. Four insulators for the telephone lines are mounted on the third cross-bar, 21 ft. above the ground. Forty of the towers were made extra heavy for use at points where the line changed its direction.

The foot plates of the towers are of cast iron, dipped in asphalt, and 24 in. in diameter. They are attached at the bottom to 4 in. x 4 in. foot posts, which are asphalted on top of the galvanizing. These posts are bolted as extensions to the corner posts of the tower, and set in the ground a depth of 6 ft. Tapered holes were dug for these foot plates and the earth was tamped back on them very carefully. No concrete

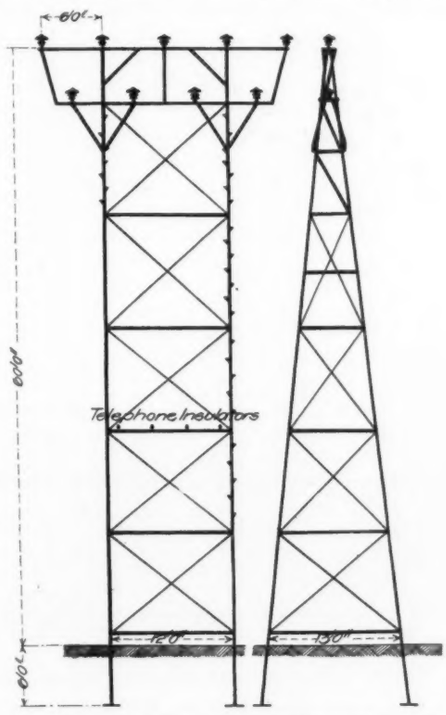


FIG. 31.—60-FT. TRANSMISSION-LINE TOWER.

footings were used, except on some special work in the city of Los Angeles, where a great many of the tower heights exceeded 60 ft. The tower parts were made as light as was consistent with rigid construction. Under the extreme conditions mentioned above the factor of safety in any steel member is specified to be not less than two and one-half.

No cast iron was permitted in the construction, except in the foot plates. All connections are made with malleable iron castings with a factor of safety of 4. The insulator pins are of cast-steel and were furnished as a part of the tower. They are secured to the tower by four bolts and are cemented into the insulators. The towers and insulator pins were furnished by the U. S. Wind Engine & Pump Company, of Batavia, Ill.

The towers were shipped from the factory knocked down

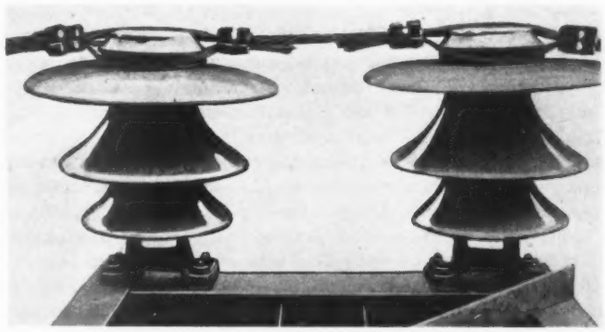
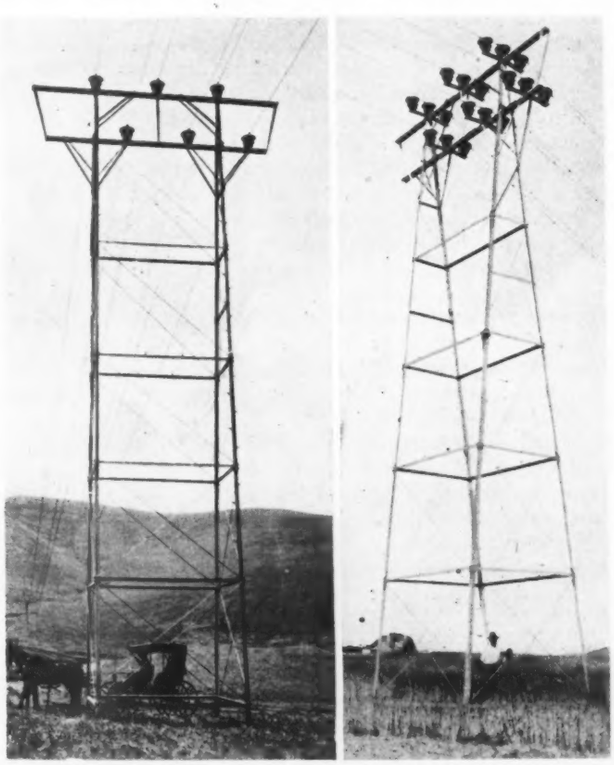


FIG. 32.—DOUBLE INSULATOR ON TOWER, SHOWING METHOD OF TYING.

with their small parts boxed and were hauled to their respective locations by wagon. They were assembled lying on the ground and "kicked" into place by means of a gin pole. This method of erection was found to be very satisfactory for all sizes of towers, and only such towers as were located in rugged or inaccessible country were built up piece by piece.

In stringing out the wire, teams were used with usually four animals, although in limited spaces two horses on a tackle



FIGS. 33 AND 34.—STANDARD 60-FT. TOWER AND A SPECIAL 60-FT. TOWER NEAR SAN FERNANDO SWITCHING STATION.

were substituted. Wherever possible, those wires which could be lifted on to the tower were strung out alongside and later on thrown into place.

LINE CONSTRUCTION.

The transmission line is designed to consist of three circuits with the wiring spaced symmetrically on 6-ft. centers. This wire is seven-strand, 4/0 hard-drawn copper, having an elastic limit exceeding 35,000 lbs. total, and an ultimate strength of

62,400 lbs. It was furnished by J. A. Roebling's Sons Company, National Conduit & Cable Company and American Electrical Works. About two and one-half million pounds of cable was used on the line.

The wire was sampled and tested at the mill before being accepted. It was greased and shipped to the purchaser on reels containing usually two 4000-ft. lengths. Some wire was also purchased in shorter lengths for convenient use in the mountain section. No special difficulty was, however, experienced in handling full-length pieces even in the most rugged country.

Before the line was designed, a large amount of experimenting was done by the Edison Company's engineers on a special thousand-foot span erected at Declez and equipped with a dynamometer and recording thermometer to obtain continuous readings of the variation in stress with changes of temperature and wind velocity. Curves showing the relation of the observed points to the calculated curve were then plotted. curves for aluminum were also prepared, the results used being those obtained by the Pittsburg Reduction Company on the line which it erected some years ago near its factory. From a comparison of these curves, it was evident that the calculation formulas were sufficiently accurate for commercial use, including all effect from elasticity, closure of strands upon themselves under increase of stress, and the slight difference in loading upon the different strands due to the center strand being straight while the others are spiraled about it and consequently have a somewhat greater length. From the formula, a conveniently arranged sag-temperature tabulation was made out and was supplied to the line-foreman in this form. These experiments were carried out under the supervision of Mr. R. J. C. Wood, acting electrical engineer for the Edison Electric Company. For convenience in checking the construction work, Mr. Wood made the slide rule illustrated in Fig. 35. By setting the required span at the index at the left, the sag will be read opposite the temperature chosen. For example, the illustration shows the scale set for a 900-ft. span, which gives a 27-ft. sag for copper at 50 deg. F. The scale is calculated for No. 0000 seven-strand copper and 344,000 c. m. 19-strand aluminum, with a maximum stress of 22,000 in copper and 10,000 in aluminum at 30 degs. F. in a 30-lb. wind.

As only six conductors were strung for the present line, it was desirable to leave the easiest circuits to be pulled in later. The threading of three cables through the tower was, therefore, desirable at this time. These were carried across rollers bolted to the arm, as were also the upper wires during tying in.

The type of clamp used is shown in Fig. 36. It is 2 ins. long, and is constructed of three pieces, the inner piece being shaped to conform to the two wires. The tie wires passing around the neck of the insulator are of No. 1 copper strand. The four-bolt clamps are of brass, while the U-piece placed in the top of the insulator to prevent chafing is of No. 24 copper. The tie wires fail in test at about 4000 lbs. The clamps will withstand somewhat more, and the construction could

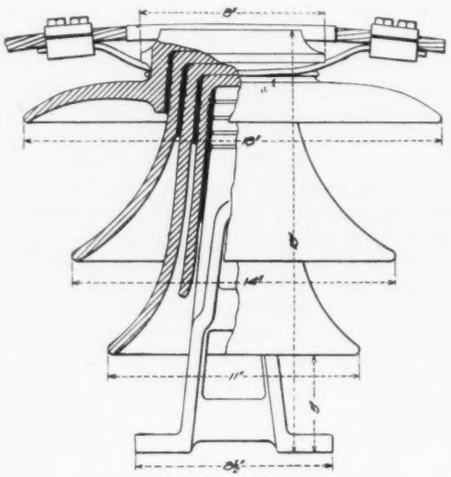


FIG. 36.—SECTION OF INSULATOR.

afford as prominent a target for malicious marksmen as do those of the ordinary brown glaze.

The insulators were all carefully tested at the factory by one of the Edison Company's engineers. The specifications called for a guarantee of a 100,000-volt test from the groove to the pin for half an hour under a precipitation of 1 in. in five minutes at an angle of 30 deg. from the vertical. The assembled insulator was required to withstand under a wet test a potential of 150,000 volts for 30 seconds, and the separate parts are guaranteed to withstand a voltage of 25 per cent in excess of the normal proportion of over-voltage test. A small quantity of brown insulators are used, they being supplied by the Thomas and Knowles factories.

The insulators are guaranteed to withstand a side strain of 4000 lbs. and actually fail at approximately 9000 lbs. The wire has an ultimate strength of 61,300, but its elastic limit, as noted above, will not much exceed 35,000. The normal failing point of the ties, 4000 lbs., is, therefore, sufficiently high for safe construction, while they are not so strong as to stand more than the wire or the insulators.

The transmission line, as stated elsewhere, is carried on spans as long as the character of the country would permit

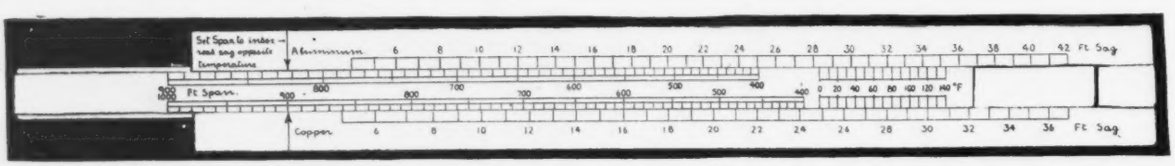


FIG. 35.—SLIDE RULE FOR CALCULATING SAG IN SPAN WIRES.

readily have been made much stronger at a slight additional expense if it had been considered desirable.

The insulators used on the Kern River transmission line are the largest yet made for commercial transmission purposes. Insulators of a greater diameter have been constructed and are in use elsewhere for special purposes, but none so large have been made for a long-distance transmission system. The Kern River insulators are 18 ins. high and 8 ins. in diameter at the grooved top. The top section is 18 ins. in diameter and the two lower petticoats are, respectively, 14 ins. and 11 ins. in diameter. Each assembled insulator weighs 50 lbs. The main contract, for 7500 insulators, or over 90 per cent of the total number, was placed with the Locke Insulator Manufacturing Company, and the specifications called for a glaze that would match the galvanized steel towers. The manufacturers were successful in producing an insulator with a light gray or slate-colored glaze which harmonizes very well with the hue of the towers. The resulting construction is comparatively inconspicuous on the transmission line and the insulators, being of this neutral shade, do not

with towers not exceeding 60 ft. in height. This maximum height was determined upon as being that which would give the lowest total cost of construction. The sags for the different spans being determined, as stated above, and the telephone clearances from transmission wires being assumed at a minimum of 7 ft., it was necessary to determine the tower spacings with minimum safe ground clearances in the different portions of the line. In order to do this accurately, survey parties were sent over the entire line, taking tower locations, and determining all elevations so that they were able to plot a profile of the transmission system showing the ele-

vation of each tower, the height of the intermediate elevations and the important topography of the country. The parties designated the height of the tower while in the field, making their profile as they went along and checking the resulting line before leaving that section of the country. What changes have been made from these locations have been due entirely to causes other than incorrect location for clearance.

A telephone circuit is carried the entire length of the transmission line, being supported on the towers about 20 ft. above

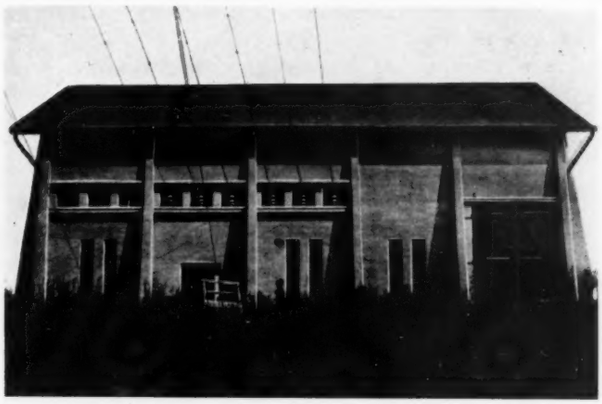


FIG. 37.—SAN FERNANDO SUB-STATION.

the ground. Between towers the wires are held up by wooden poles, two poles being necessary between towers for an average 700-ft. span.

SWITCHING STATIONS.

The transmission lines are carried through from one end to the other with transpositions only at switching stations. There are at present only three such buildings, at Tejon, Castaic and San Fernando, the latter two of which contain transformer sub-stations.

The switching station proper is equipped with two sets of oil-break switches for each line and two sets of knife-blade disconnecting switches for each line. The oil switches are connected, one set after another, into a complete circle. After passing through the disconnecting switches, the incoming lines are tapped between alternate oil switches. From the vacant jumpers left after these lines have been tapped in, their corresponding outgoing circuits are taken, and after passing through the disconnecting switches, leave the building on the opposite side.

The switching station buildings are constructed of concrete in the most substantial manner. The circuits are isolated from each other by means of concrete barriers and floors. Individual leads of the same circuit are, however, run in the same compartment. In spite of the large number of crossings called for by the wiring diagram, the dimensions of the building are not excessive. The Castaic sub-station is 66 ft. long and 41 ft. 6 ins. wide, with a cross-partition wall forming the switch-room. 40 ft. wide, and the transformer room 26 ft. wide. Provision has been made to connect horn lightning arresters to the circuits at these sub-stations, if it is found necessary after the line has been operated for some time.

The two transformer sub-stations have in their switching houses an arrangement identical with that in the other stations, except that openings were made in the west wall, through which leads were taken into the adjacent transformer house. The two were built together under the same roof and with continuous sidewalls so that there is on the exterior little to indicate the difference between the two ends of the station. In the transformer house provision has been made for two banks of 2100-kw transformers from the transmission line at 60,000 volts and delivering to the distribution at 30,000. The high-tension leads are tapped from two of the out-going 60,000-volt circuits in the switching house, and after passing through oil switches join in a common bus from which the transformers can be separated by means of knife-blade switches.

This switching, with the exception of the transformer switches, is on a concrete deck forming a complete second story in the switching house, 18 ft. above the floor. On the under side of this floor, there are also mounted the insulators for the 30,000-volt circuits. The 30,000-volt oil switches are, however, placed on top of the floor. The lightning arresters for the 60,000-volt circuits are on the wall between the transformer and the switch house, and are separated from each other by 6-ft. barriers, while the 30,000-volt arresters are against the end of the sub-station immediately below the oil switches and the outgoing 30,000-volt circuits.

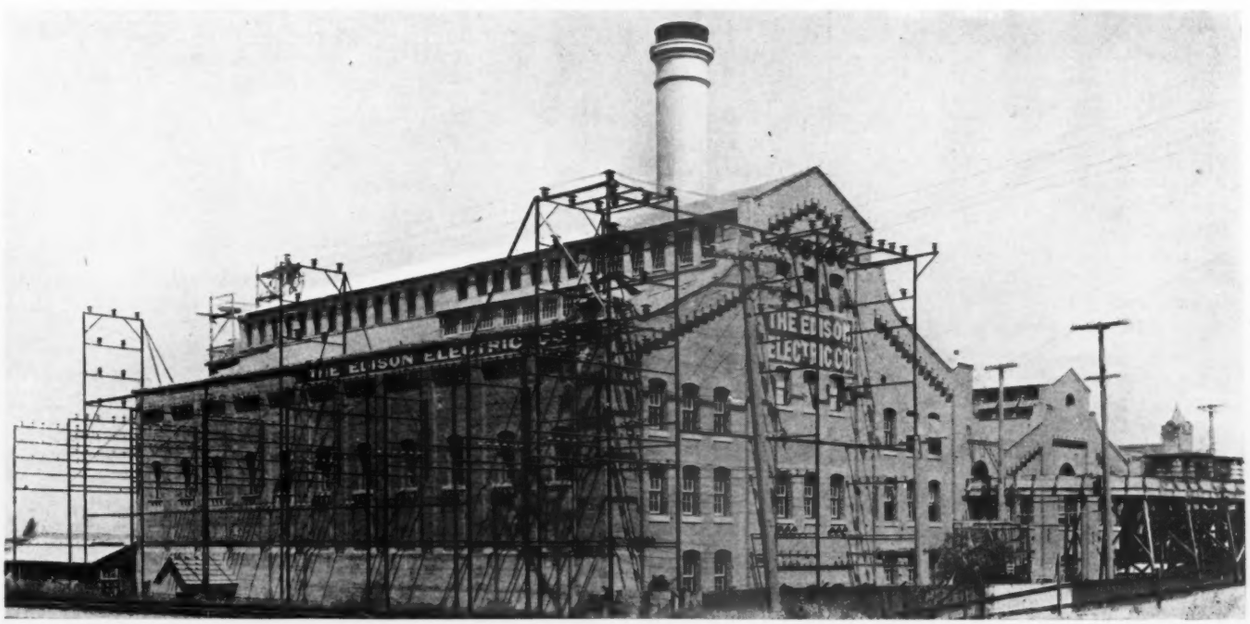


FIG. 38.—LOS ANGELES NO. 3 RECEIVING STATION, SHOWING 60,000-VOLT, 30,000-VOLT AND 15,000-VOLT CIRCUITS.

At Castaic there will be installed at present one bank of transformers, 2100 kw, oil-filled and water-cooled. These transformers will supply power to a 30,000-volt, 40-mile transmission system now being built by the Ventura County Power Company, west from Castaic to Saticoy, where a branch is taken off to Oxnard, while the main line continues

to Ventura. This branch will eventually be continued to Santa Barbara, 30 miles farther, where the Edison Electric Company has extensivev power and railway holdings.

At San Fernando there will be installed a 1200-kw bank, which will supply power at 2300 volts to lamps and motors.

LOS ANGELES RECEIVING STATION.

The Kern River No. 1 transmission line terminates in Los Angeles, 117 miles from the power plant, at the steam and transformer station known as Los Angeles No. 3. This station, which was partially described in the ELECTRICAL WORLD AND ENGINEER of March 11, 1905, is constructed to receive, transform and distribute to the local sub-stations power transmitted from the company's water-power plants on Santa Ana River, Mill Creek, Lytle Creek and Kern River, and also contains a large steam auxiliary plant to supplement the water-generated power. It receives power at 60,000 and 30,000 volts and generates and distributes at 16,000 and 2300 volts.

Both of the Kern River circuits enter the station through the east gable, as shown in Fig. 40. After passing through choke coils the lines enter oil switches which connect them to their respective bus-bars. There is also an oil tie switch between the two buses. Each transformer has an oil switch which can be connected by means of a double-throw knife-blade switch to the bus-bars belonging to the west or to the middle circuit. When the east circuit comes in it will have a pair of oil switches so that it can be run on either of the bus-bars.

There are four step-down 4500-kw transformer banks, with their secondaries wound for either 16,000 or 32,000 volts. Under ordinary conditions, all energy received from Kern River will be handled through the double 15,000-volt bus. The transformers are cooled by forced-oil circulation. The oil, after leaving the transformer, is handled in the same manner as at Kern River. It enters a receiver, is forced by variable-speed centrifugal pumps into boiler-tube cooling coils outside the building and passes back into the pressure line which fills the transformers. There being no extensive supply of cold water available, the cooling water is circulated continuously from the oil cooler basin into elevated troughs from which it drops over a series of screens, where it is cooled immediately before falling on the section containing the hot oil.

This building also contains provision for switching the old 30,000-volt, 80-mile transmission line, fed by the Santa Ana and Mill Creek plants, with its various branches and all the 15,000-volt distribution around Los Angeles. The arrangement of the various circuit bus-bars, oil switches and the transformers is shown in the accompanying diagrams. All switches and circuits are controlled from a 12-panel switchboard on the gallery of the turbine room, which is equipped with the necessary control switches and instruments for the 60,000, 30,000, 15,000 and 2300-volt buses.

All bus-bar wiring connections to the transformers and the outgoing circuits are carried in ducts. In the new portion of the station these are filled with 15,000-volt leaded paper cables of 211,000 cm cross-section, with the exception of those for the Westinghouse turbo-generator, which has 400,000 cm cables.

There were installed in the steam end of this plant during 1903 two 2000-kw, 2300-volt Curtis turbo-alternators, with 4000 horse-power of Stirling boilers, in 500-hp units. When it became necessary to order an extension for the plant, in 1905, larger size apparatus was determined upon throughout. An additional 5250 horse-power in 750-hp units was installed in the boiler room.

The turbine installation in the new plant consists of a single 6000-kw Westinghouse-Parsons turbo-alternator, with

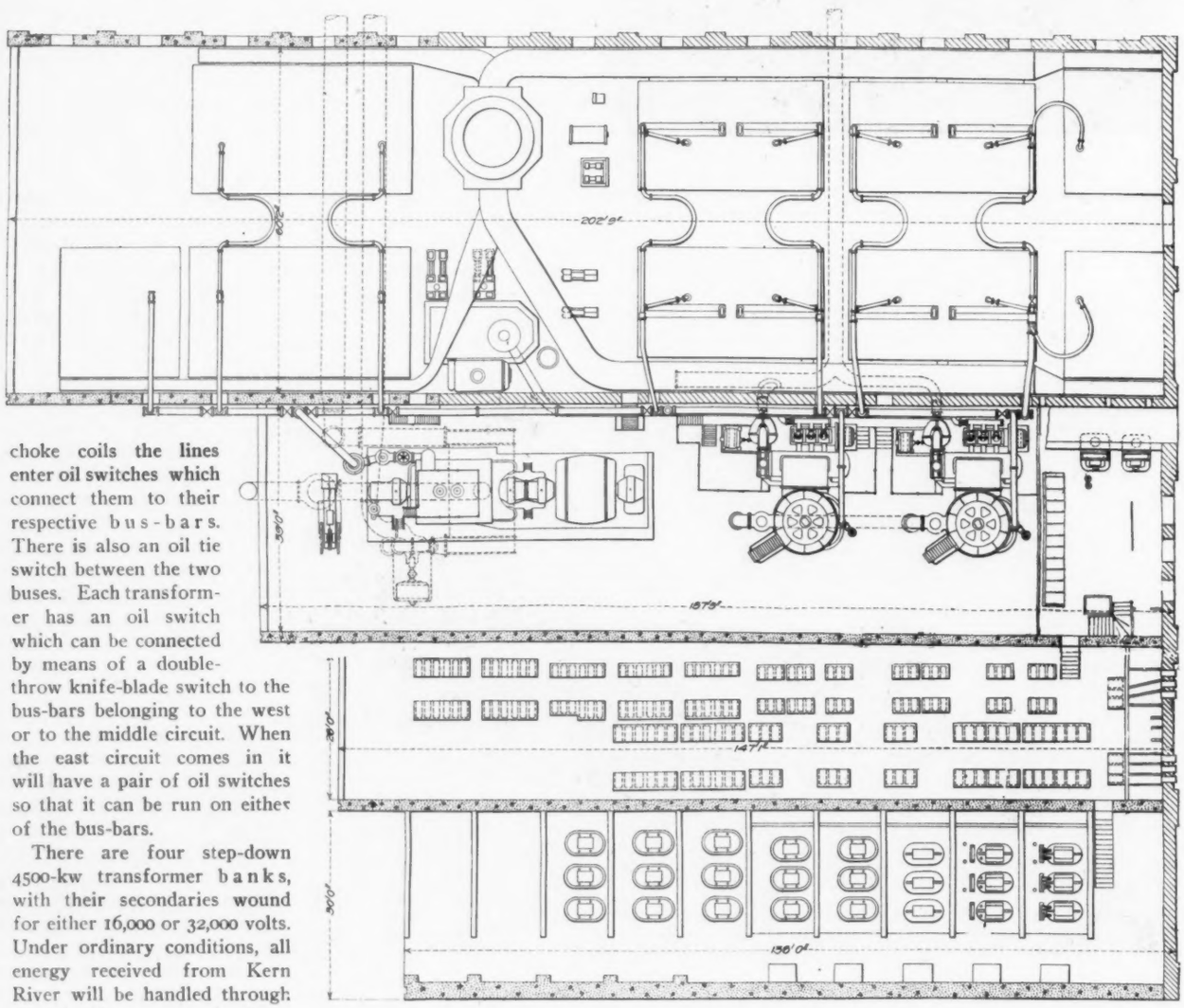


FIG. 39.—PLAN OF LOS ANGELES NO. 3 RECEIVING STATION.

Worthington condensing equipment. The steam end is of the Westinghouse standard construction, receiving steam through an intermittent valve. This steam, before reaching the machine, passes through a separator, an automatic butterfly valve, and a hand-operated throttle valve. This unit is four-stage, single-flow, and is operated at from 27½-in. to 28-in. vacuum. Thus far loads up to 10,000 kilowatts have been carried on the machine without any indication of its maximum load being approached. The by-pass throttle does not open until a load of 9000 kilowatts is reached under normal steam and vacuum conditions.

The generator is wound for 16,500 volts, star connected, and is run with grounded neutral on the 50-cycle distribution of the company. The generator operates perfectly and runs in multiple with the main system without causing any disturbance whatever. Between the neutral of the machine and the station ground wire, a potential difference of several hundred volts exists under operating conditions, with the machine in connection with star-to-delta-connected transformer banks. This voltage and the resultant flow where the neutral switches close vary with the number of transformers and the load on them, but does not apear to vary from other causes. An observation of the wave shape across the neutral connection showed a somewhat peaked potential wave at three times the frequency of the main circuit. For the present the exchange current is limited by the insertion of the choke coil in the neutral connection. At a later date a resistance will be substituted for the coil. This phenomenon in one shape or another is observable on all Y-connected four-wire generator installations.

Steam from the exhaust end of the turbine passes to the atmosphere during warming up through an automatic release valve. After the machine is up to speed, 750 r. p. m., the steam is condensed into a 24,000-sq. ft. condenser, and the water of condensation returned to the hot-well by a two-stage motor-driven centrifugal pump. The vacuum space is cleared of entrained air by means of a steam-driven dry-vacuum pump. Forty-nine cu. ft. of condensing water are forced per second through the condenser by means of a 30-in. Volute centrifugal pump, direct-connected to a 450-hp induction motor, receiving power from the 2300-volt station mains.

A transformer bank stepping from 15,000 to 2200 volts is to be connected to the machine leads so that the auxiliaries can be transferred to the generator leads after the unit is in full operation.

Circulating water leaving the condenser passes beneath the boiler room in a steel-lined, concrete duct to the edge of the cooling tower, where it rises through a steel pipe to the top of the tower. The new portion of the tower installed for the Westinghouse unit is 73 ft. x 150 ft. in floor plan and the water has a clear fall of 27 ft. This gives a tower area of 6100 sq. ft. per cubic foot of water per second and with a humidity of 58 per cent and a wind velocity of six miles per hour, the water temperature is reduced from 102 degs. F. to 85 degs. F. The tower framing consists of 4-in. x 4-in. posts, 2-in. x 4-in. intermediates, 1-in. x 2-in. horizontals, and 1-in. x 3-in. bracings. The main flume is placed on 6-in. x 6-in. posts and is itself built of 1½-in. redwood. The distribution troughs are built of galvanized iron, having rectangular cross-sections with round holes punched in their bottoms. Their headers are also of galvanized iron, with wooden sliding gates. Strips 18 ins. wide of galvanized-iron mesh screen are placed at 3 ft. intervals throughout the depth of the tower. The trough spacings are 36 ins. x 36 ins. x 66 ins. throughout the tower.

The reservoir is of concrete 6 ft. deep, and 12 ft. wider than the tower. Water passes from it into the concrete suction pipe through close-set iron grizzlies. Its flow can be shut off when necessary by a 38-in. iron motor-driven gate placed in the engine-room basement.

The Westinghouse turbo-alternator unit was put in service in October, 1906, and has been run ever since without any shut-down due to the turbine, and without any serious shut-down whatever. The preliminary acceptance test gave results materially better than the manufacturer's guarantee.

PROJECTED KERN RIVER AND KINGS RIVER PLANTS.

In addition to the Kern River No. 1 plant, the Edison Electric Company has four plants located on Kern River. These plants are further up the river than the plant just completed, and cover the entire 160 miles length of the river from the mouth of the cañon to the headworks, with the exception of the plant of the Power, Transit & Light Company at the mouth and the Kern River Company's plant about 30 miles above. These four additional plants will have a total output of 46,600 kw and will be developed as the demand for the power arises. The next plant to be constructed will be Kern River No. 2, the power house for which will be located immediately above the intake of the No. 1 plant. Its diversion works will be 15 miles above, just below the Kern River Company's station. With the 317 feet net head which will be available, this plant will develop a total of 11,600 hp with 400 cu. ft. of water per second. Some work has already been done on this plant and before long the construction will be prosecuted more actively.

In addition to the Kern River power location which the

FIG. 40—VERTICAL SECTION OF LOS ANGELES NO. 3 RECEIVING STATION.

Edison Electric Company owns in entirety, the company has a two-thirds interest in five excellent power sites on the Kings River where 95,000 kw can be developed.

CONCLUSION.

As mentioned in the articles appearing in the ELECTRICAL WORLD AND ENGINEER two years ago, the earlier water-power plants of the Edison Electric Company consist, in the order of their construction, of Mill Creek No. 1 (original Redlands); Santa Ana No. 1, Mill Creek No. 2, Mill Creek No. 3, Santa Ana No. 2, and Lytle Creek. These plants, which have a total output of 8700 kw are located in San Bernardino county, and in addition to supplying local power demands in the vicinity transmit power at 30,000 volts by means of an 80-mile transmission line to Los Angeles.

In addition to the water-power plants the company has a

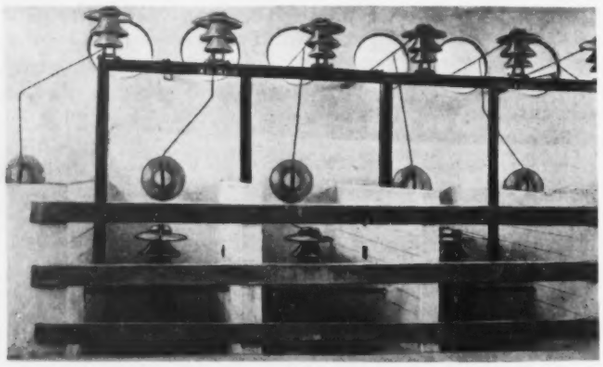


FIG. 41.—HIGH-TENSION LINES ENTERING LOS ANGELES NO. 3 RECEIVING STATION.

steam generating rating of 14,075 kw. It is expected that the Kern River plant will be able to deliver in Los Angeles a maximum of 23,000 kw. This with the other water-power plants will give a normal hydro-electric generating rating of about 30,000 kw delivered in Los Angeles. Thus far the company's maximum peak load has been about 20,000 kw. However this by no means indicates the demand made on the company for power, and it is the company's expectations, judging by past exerience, that all of its power will be con racted for as fast as it is available. The Edison Company is the only power corporation in Southern California that aims to keep ahead of the demand for power by the construction of new plants, and this policy has proved an excellent one as compared with some of the other power interests who have at times been badly crippled by an insufficient supply, and have had to call on the Edison Company for power.

The cities in Southern California supplied with electric power for lamps and motors by the Edison Electric Company comprise a population of 418,500 and include Los Angeles, Pasadena, Pomona, Santa Ana, Redlands, Santa Barbara, Santa Monica, Ocean Park, Venice, Long Beach, Monrovia, Whittier, Riverside, Colton, San Pedro and Redondo. The transmission lines traverse Los Angeles, Orange, Riverside, San Bernardino, Kern and Ventura Counties.

Gas plants are operated in each of the cities named with the exception of Los Angeles, Pasadena and Redondo, the Santa Monica plant supplying Ocean Park and Venice. The gas plants have a generating capacity on a 12-hour run of 1,798,000 cu. ft. and double that for 24 hours. A storage capacity of 590,000 cu. ft. is provided. Crude oil is used for fuel.

As indicative of the conservative and efficient management of the properties under the company's control, it is interesting to note that in the four years, 1903 to 1906 inclusive, the proportion of operating expenses to gross earnings has been reduced from 52 per cent to 41 per cent. The following table covering the field of activities of the company as of record on January 1, of each of the years, 1905, 1906 and 1907, shows the excellent growth made during those years, and also incidentally illustrates the effectiveness of the selling and publicity campaigns carried out by the company.

TABLE SHOWING GROWTH OF BUSINESS OF EDISON ELECTRIC COMPANY.

	Jan. 1, 1905.	Jan. 1, 1906.	Jan. 1, 1907.
Incandescent lamps connected (16 cp equivalent)	351,334	460,791	586,105
Electric meters in service	19,713	25,321	32,764
Gas meters in service	4,474	9,992	14,650
Total number of meters connected	24,187	35,313	47,414
Motors in service	721	1,346	2,140
Horse-power of motors in service	7,803	13,605	19,662
Arc lamps served	1,319	2,225	2,740
Gas stoves installed	4,547	10,567	15,772

Several interesting conclusions can be drawn from a study of these figures. For example, in the two years, 1905 and 1906, the company's incandescent lamp service increased 67 per cent with an increase of 66 per cent in the number of meters. Gas meters increased 227 per cent, and a corresponding increase of 247 per cent in the number of gas stoves installed indicates a remarkably efficient sales staff in the gas department. The figures also indicate that there is practically no gas illumination in the territory served by the Edison Company. The number of electric motors installed increased 197 per cent with an increase of 152 per cent in their horse-power. The average horse-power per motor decreased from 10.82 to 9.18, indicating an increasing use of small motors, presumably in small manufacturing lines.

The Edison Electric Company is incorporated under the laws of Wyoming and has issued $11,200,000 of its capital stock, consisting of $4,000,000 preferred and $7,200,000 common. The company has outstanding $10,895,000 in bonds and debentures.

The following-named gentlemen are officers of the company: President, John B. Miller, Pasadena; vice-presidents, Henry Fisher, Redlands; Wm. R. Staats, Los Angeles; H. H. Sinclair, Pasadena; John W. Edminson, Los Angeles; secretary, R. H. Ballard, Los Angeles; treasurer, W. L. Percey, Pasadena; general manager, A. L. Selig, Los Angeles.

The construction of the Kern River No. 1 power plant was prosecuted under the general supervision of H. H. Sinclair, vice-president of the company, who originally located the power sites on the Kern River and on most of the other streams whose power supplies are controlled by the Edison Company. The hydraulic features of the Kern River work, including the dam, gravity tunnels, pressure tunnel and many of the details

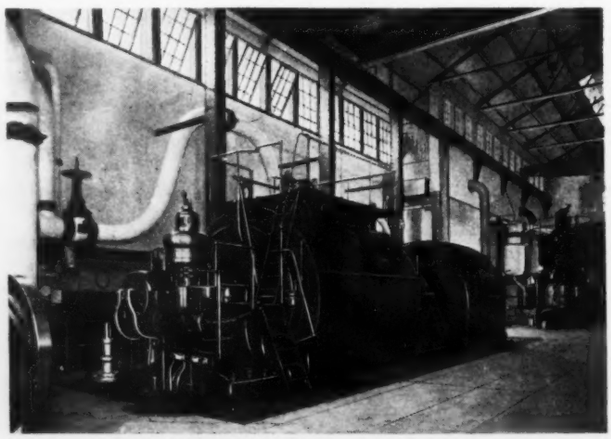


FIG. 42.—INTERIOR OF TURBINE ROOM OF LOS ANGELES NO. 3 STATION.

of the water-wheel equipment were designed under the supervision of F. C. Finkle, chief hydraulic engineer, and now consulting engineer for the company. F. E. Miller, as superintendent of power development had charge of and, at times, direct supervision over, the construction work. The electrical details were looked after by Ralph Bennett and R. J. C. Wood. G. E. Decker represented the company in the installation of the machinery. John Taylor, formerly chief operator at the Santa Ana No. 1 plant, has been placed in charge of the operation of the Kern River No. 1 plant. To these gentlemen the writer is indebted for many courtesies and for the furnishing of the drawings and much of the data which have made these articles possible.

Cos Cob Power Station of the New York, New Haven & Harttord Railroad Co.

IN connection with the descriptions of the catenary line construction and the electric locomotives used by the New York, New Haven & Hartford Railroad, which appeared in our issues for Aug. 17 and 24, it is appropriate to add a description of the generating station from which electrical energy is obtained for train propulsion. This station is interesting, both on account of what it contains and by reason of what it does not contain. Thus the interest is not distinguished by the fact that a considerable portion of the equipment is of the standard type. However, the changes that have been introduced in order to render the standard equipment suitable for the special duties imposed upon it are of exceptional interest at this time.

The power house is located adjacent to the main line of the railroad and on the bank of the Mianus River at a point on the river about one mile from Long Island Sound. The location is such that coal can be delivered either by water or rail, and an unlimited amount of salt water for condensing purposes is available from the Mianus River. By the erection of a dam in this river at a point about a mile up-stream from the power house an abundant supply of exceptionally pure boiler feed water is also readily obtained.

The general style of architecture of the power house building is Spanish mission; the walls being constructed of plain-faced concrete blocks, the color of which forms a pleasing contrast with the red Spanish tile roof. The building walls, below the water-table, and the machinery foundations are monolithic concrete. The water-table and the walls above it, including the window arches and coping, are of concrete blocks. The basement floor is of concrete, laid upon the foundation rock. All other floors in the building are of reinforced concrete; and the roof, which has a pitch of 4½ ins. per foot, is of reinforced cinder concrete finished on the exterior with Ludowici tile.

A self-supporting steel stack 13 ft. 6 ins. in diameter, extending to a height of 100 ft. from the engine room floor is carried by the steel columns which support the fan room floor, leaving the space below, on the boiler room floor, entirely clear.

The turbine room is 60 ft. wide by 112 ft. long, and the switchboard occupies a space next the turbine room which is 25 ft. wide by 110 ft. long. The boiler room is 160 ft. long and 110 ft. wide. The reduced head room needed for horizontal turbine equipment is shown by the fact that the distance from the floor to the top of the crane runway rail is but 27 ft. 2 ins., and the height from the turbine room floor to the bottom of the roof trusses is but 39 ft. 2 ins. The interior walls of the engine room are finished with a wainscoting of Faience tile 6 ft. in height.

TURBO GENERATORS.

The initial generating equipment of the power house consists of three multiple-expansion, parallel-flow Parsons steam turbines direct-connected to single-phase Westinghouse generators. Provision has been made for the installation of a fourth unit, of corresponding size. The turbines are rated at 4500 bhp each, and the generators at 3000 kw each, at 80 per cent power factor.

FIG. 2.—BOILER ROOM OF COS COB POWER STATION.

The turbines are operated at 1500 r. p. m. by steam at 200 lbs. pressure and 100 degs. superheat. The continuous overload capacity of the units is 50 per cent, and momentary overloads of 100 per cent can be taken care of when operating condensing. The turbines are equipped with the latest accessories in the way of automatic safety stops, water-packed glands for the turbine shaft, and adjustable water-cooled bearings equipped with a continuous circulation oiling system.

As the requirements necessitated the generation of three-phase

FIG. 1.—EXTERIOR VIEW OF COS COB POWER STATION, SHOWING COAL-HANDLING EQUIPMENT.

current for delivery to the New York Central system as well as single-phase current for the operation of the electric locomotives over the New Haven Railroad, the generators are wound for three-phase current, but arranged for the delivery of both three-phase and single-phase current.

The generators are entirely enclosed by a casing, into which air is drawn through suitable ducts from a fresh air chamber under the switchboard gallery, and from which the air is discharged through other ducts into the basement. This system of generator ventilation renders the operation of the generators practically noiseless.

The excitation of the generator fields is provided for by two 125-kw, direct-current generators, direct-connected to Westinghouse engines; and one motor-driven exciter.

STEAM AUXILIARIES.

A separate condensing outfit is provided for each turbine, consisting of an Alberger three-phase counter-current surface condenser, a two-stage dry-air pump, a centrifugal circulating pump direct-connected to a Westinghouse engine, and a Monitor hot-well pump, the speed of which is automatically controlled by a float.

Condensing water for all the condensers is furnished by a single flume, which is constructed of timber having a lining of creosoted lumber from the intake at the face of the dock to the shore line, and of concrete for the remainder of its length to and under the generator room. To prevent the rapid deterioration of the brass condenser tubes by the galvanic action which usually occurs where salt water is employed for condensing purposes and which is often aggravated by stray currents passing through the water pipes into the station, and from thence to the condensers and out through the pipes leading into the intake and discharge flumes, a motor generator set has been installed and provided with suitable controlling apparatus for maintaining in each condenser a counter electromotive force slightly in excess of the electromotive force due to the galvanic action and the stray currents.

The initial installation consists of twelve 525-hp Babcock & Wilcox water-tube boilers set in batteries of two boilers each, and arranged with eight boilers on one side and four boilers on the other side of the boiler room, separated by a 21-ft. firing floor. Provision is made for four additional boilers to take care of the fourth turbo-generator unit when it is installed. These boilers are equipped with Roney mechanical stokers and Babcock & Wilcox superheaters and deliver steam at 200 lbs. gage pressure and 125 degs. superheat.

Under ordinary conditions the boiler feed-water is delivered from the pump house at Mianus through a 10-in. main to a concrete reservoir of 600,000 gals. capacity situated just outside the power house. From this reservoir the make-up water flows by gravity to two 13,000 gal. feed-water tanks located in the boiler room basement. These tanks also receive the discharge from the hot-well pumps. The water is then drawn from these tanks by the feed pumps and delivered through the feed-water heaters and economizers into the boilers. An auxiliary source of feed-water supply is provided for by a connection to the mains of the Greenwich Water Company.

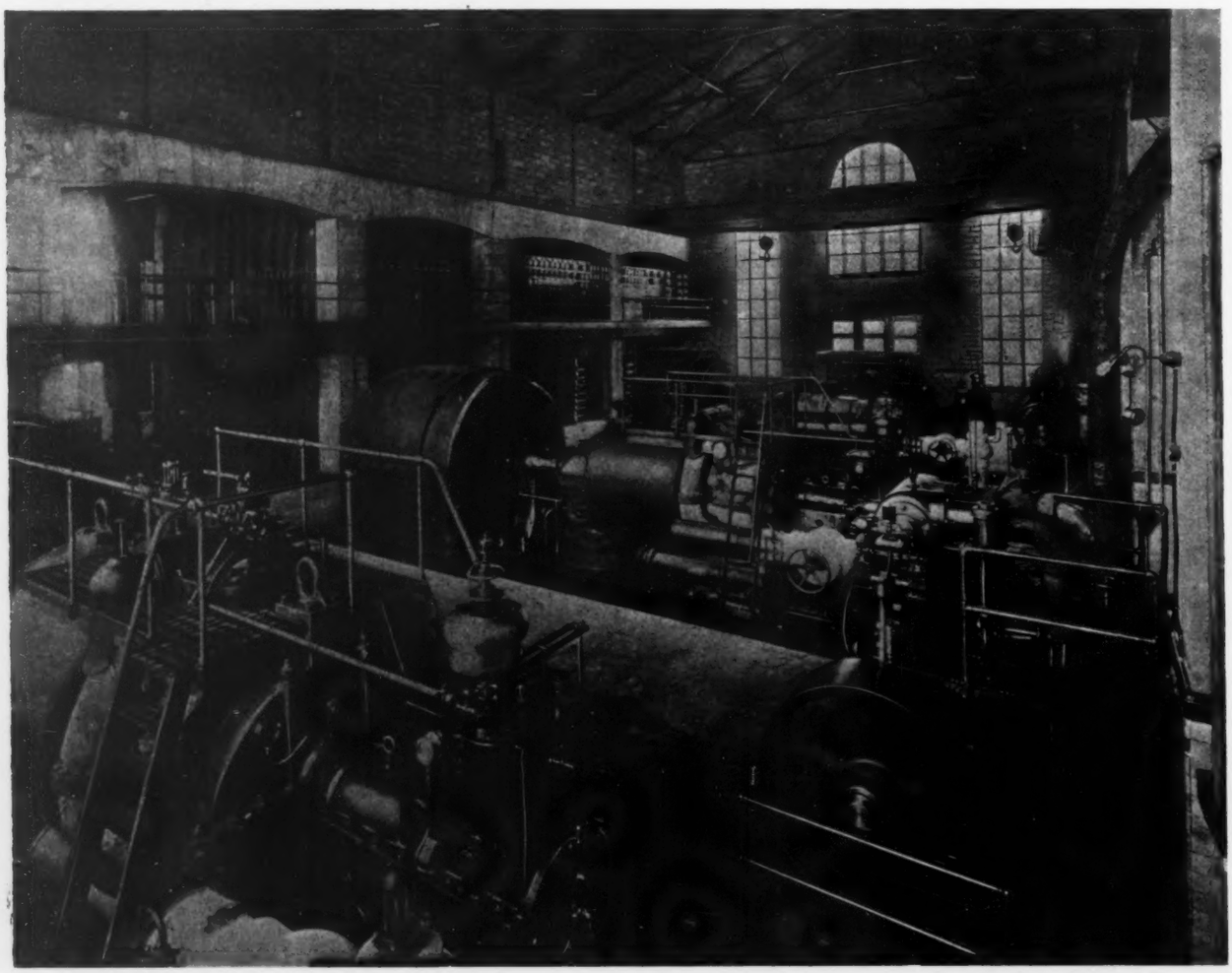


FIG. 3.—INTERIOR VIEW OF COS COB POWER STATION, SHOWING GENERATORS, EXCITERS AND SWITCHBOARD.

The feed pumps, which are three in number, are of the compound, direct connected, duplex, outside-packed plunger type. The pumping equipment at Mianus comprises two single-acting vertical triplex plunger pumps, geared to Westinghouse three-phase motors. One of these is of sufficient capacity to meet the requirements of the plant running non-condensing, and the

other to supply all the fresh water needed when running condensing. These pumps are operated by current obtained from the power house.

Three Green fuel economizers are provided.

After leaving the economizers the flue gases pass through sheet-iron flues to the fan chamber over the center of the boiler room. Here four 14-ft. fans, direct connected to horizontal high-speed engines, deliver the flue gases to the stack, which is only of sufficient height to carry the gases away from the building.

COAL HANDLING INSTALLATION.

All coal received by water is unloaded from the barges by a steel derrick operating a clam-shell bucket and delivered into a hopper of 15 tons capacity at a height of 55 ft. above the dock. This bucket is operated by an engine on the dock, supplied with steam from the power house. From this hopper the coal is fed by gravity into a coal crusher, and from the crusher it drops into steel cars where it is weighed. The cars are then drawn by cable up an inclined single-track railway of 13 per cent grade and into the boiler room through an opening near the roof. This track is supported upon structural steel towers and is designed so that two cars can be operated upon it, passing each other through an automatic turn-out at the center. The cars discharge the coal into a hopper, from which it is delivered into two flight conveyors extending the length of the boiler room. Openings in the bottom of the flight conveyors discharge the coal into spouts leading to the stoker hoppers of the boilers. The capacity of the flight conveyors is in excess of the amount of coal required to operate the boilers, and the surplus coal is discharged at the further end of the boiler room into a concrete storage bin below the boiler room floor.

Coal received by rail is dumped from the car directly into a chute leading to this same storage bin. When the boilers are to be supplied from this source, the coal is discharged from the bin by gravity into a coal crusher and from thence into a bucket conveyor located in a tunnel underneath the bin, by which it is delivered to the flight conveyors above the boilers and thence through the chutes to the stoker hoppers.

The cable railway and the flight and bucket conveyor are operated by three-phase induction motors taking energy from the "station service" line.

For cleaning the generators, switches, etc., compressed air is furnished throughout the engine room and switchboard gallery by means of a locomotive type of air compressor, supplying air at 100 lbs. pressure.

A continuous circulating oiling system for the turbine and generator bearings is installed. The oil is elevated by a small steam pump into a tank situated in the fan room and flows from this tank by gravity to the various bearings. After passing through the bearings it is discharged into a filter, and from the filter the oil passes to a receiving tank in the engine room basement to which the suction of the oil pump is connected. Taps are placed in this line at convenient points for filling the oil cups on the auxiliary engines and pumps.

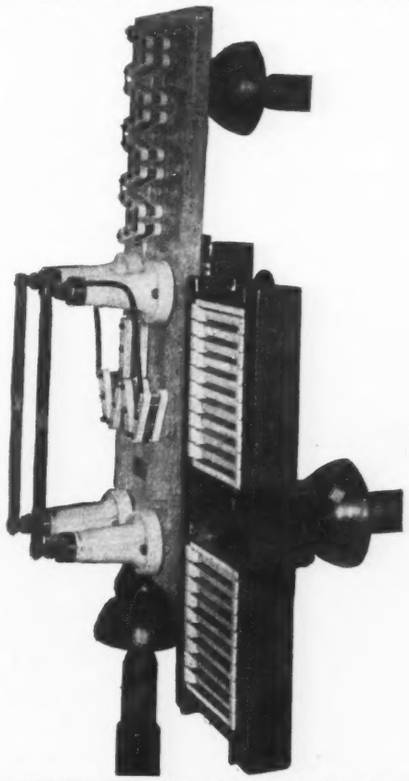


FIG. 5.—SPECIAL LOW-EQUIVALENT LIGHTNING ARRESTER.

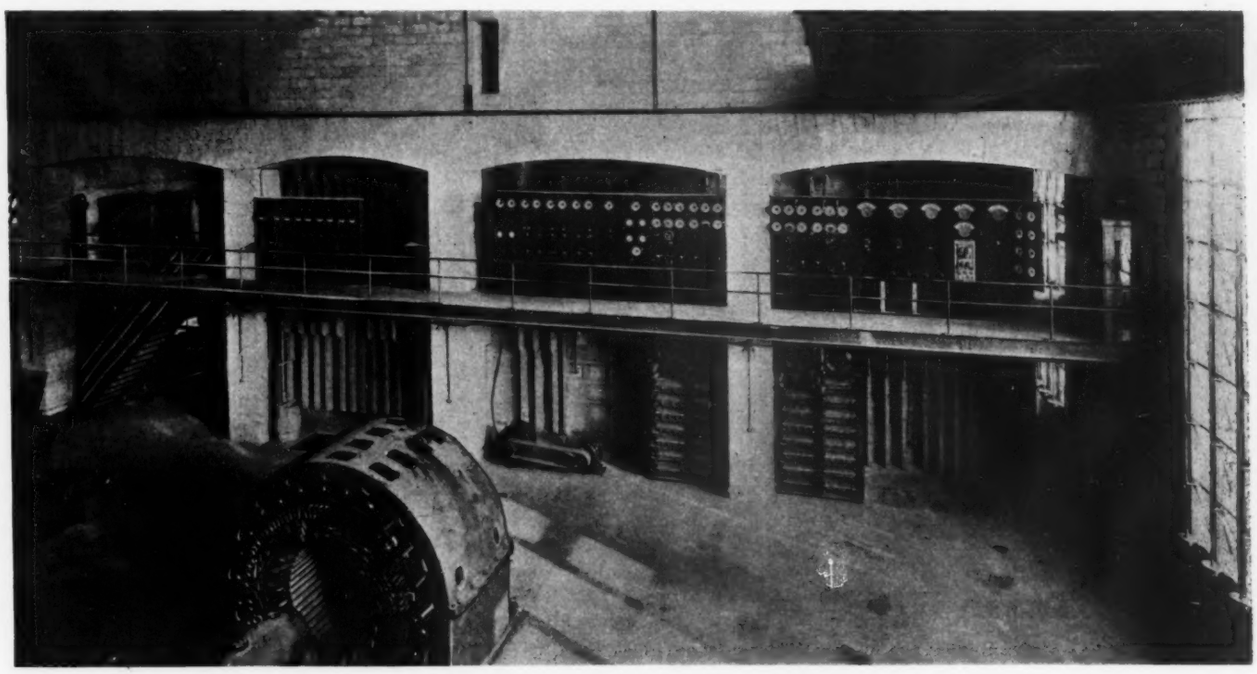


FIG. 4.—MAIN SWITCHBOARD GALLERY IN COS COB POWER STATION.

ELECTRICAL DISTRIBUTION.

The main cables from each generator are run in the air chamber under the turbine room floor, up to the switchboard gallery and thence through selector oil circuit-breakers down to the high-tension buses under the switchboard gallery. These circuit-breakers are electrically interlocked so that the buses cannot be paralleled.

The two high-tension buses, with their accompanying switching equipment are interchangeable and are arranged so that each can be used separately; one supplying three-phase current to the Port Morris feeders, and the other supplying single-phase current for the locomotives. Each bus is further divided by knife switches into three sections; each end section containing generator leads and propulsion feeders, and the center section containing the Port Morris feeders, so that in an emergency a still further subdivision can be effected.

When a bus section, or the entire bus, is used for supplying single-phase propulsion current, one leg is grounded directly to the track rails of the right of way through suitable switches; another leg supplies the outgoing feeders, which are run in duplicate, connecting directly to the trolley and which form the complete single-phase circuit; the third leg of this bus is also connected to a feeder which is carried along the right of way for the purpose of supplying energy for local purposes and completing the three-phase circuit along the line.

To show that a three-phase generator can be operated as a single-phase machine without excessive loss in output, it may be mentioned that if in a star-connected three-phase generator the e. m. f. is E volts per phase and the current is I amperes per lead the total output is $3IE$; when the same machine is used as a single-phase machine the e. m. f. is $\sqrt{3}E$ volts and the current I amperes, so that the output is 1.732 IE, or 57.7 per cent of its former value. When the machine is given a combined three-phase and single-phase load, its output increases gradually to 100 per cent, as the three-phase load becomes more and more predominating.

For normal operation of this station one set of buses will supply the three-phase feeders leading to Port Morris, and the other set the single-phase propulsion feeders and the local three-phase circuits.

Each leg of the high-tension bus, consisting of two 3-in. x ¼-in. copper bars, is enclosed in a separate masonry compartment composed of pressed brick and soapstone, and is supported on porcelain pillars and bushings projecting from the side wall of the compartment, the bushings providing for cable connections to the bus. Removable glass doors are provided in the bus compartments at small openings opposite all connections and supports. The connections between the bus-bars and the circuit-breakers, which consist of insulated cable, are carried up in separate brick septums on the back of the bus-bar and oil circuit-breaker structure. Each oil circuit-breaker can be disconnected from the bus and circuit by hook-type knife switches located on the rear of the structure.

The feeder cables pass along the top of the circuit-breaker

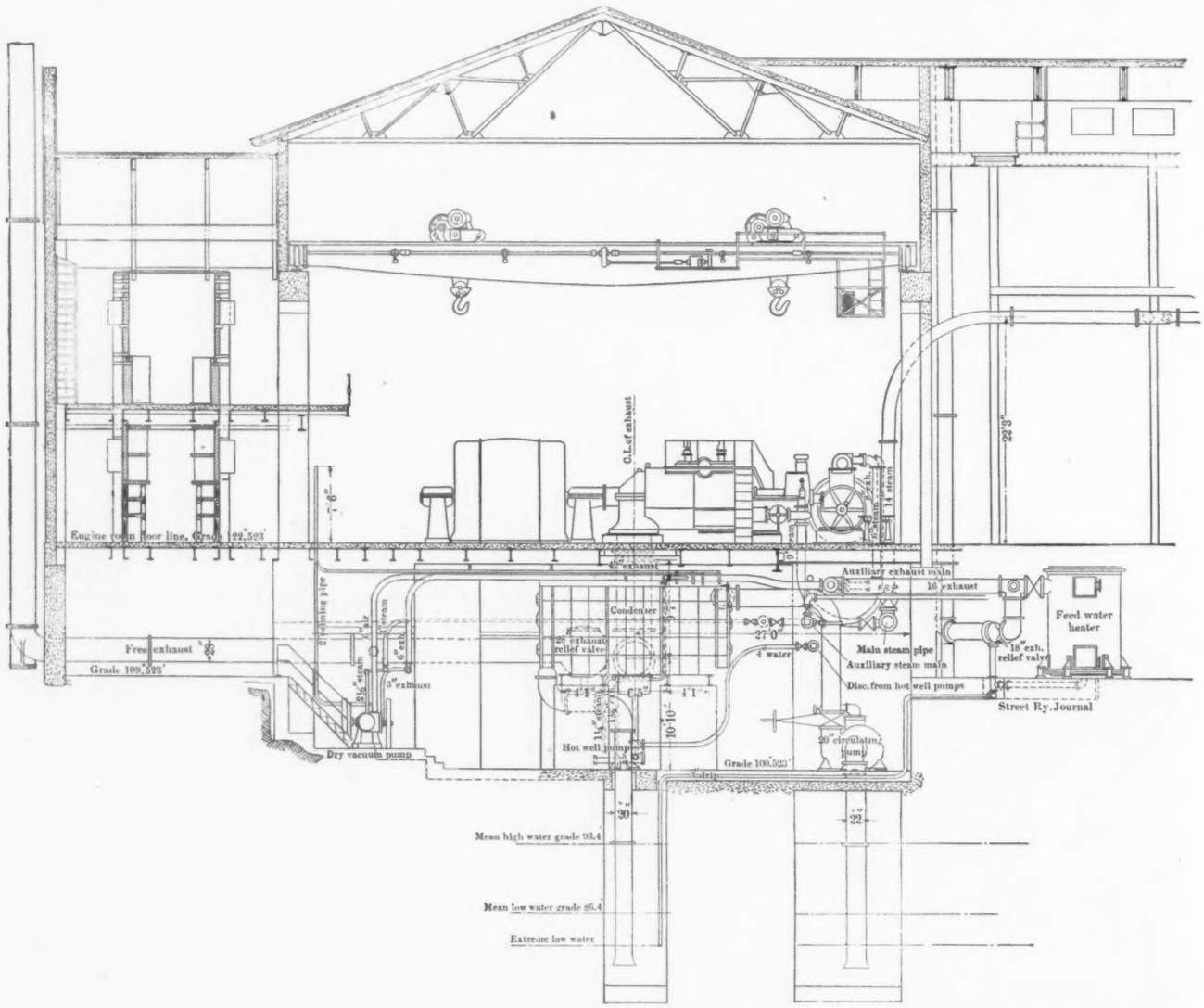


FIG. 6.—LONGITUDINAL SECTION OF COS COB POWER STATION.

structure, thence to choke coils in the arrester gallery and through special windows to the line.

The arresters used in the generating station are of the multigap, non-arcing, low-equivalent type, in which respect they do not differ essentially from standard arrester equipments. An unusual feature resides in the use of a double auxiliary series of non-arcing gaps which are connected to the ground through enclosed fuses, as illustrated in Fig. 5. Considering the arrester in detail, it is to be noted that the main series of gaps is connected between the line wire and the ground with a resistance in series on the ground side; an additional resistance is placed in shunt to certain of the main gaps. The two series of auxiliary gaps with their separate fuses are joined in series with the main gaps on the ground side, and hence are in parallel with the resistance which is in series with the main gaps. It will be observed that if only one of the fuses blows, the other continues to be in operative condition; while if both fuses blow, the arrester is merely converted into a protective device of the low-equivalent type. It is expected that minor discharges will pass across the arrester without damaging the fuses, and that the fuses will blow only in the case of excessive discharges which, with the more usual arrester arrangement, would probably cause the station to be thrown out of commission due to the opening of circuit-breakers.

The voltage of each high-tension bus is maintained constant by a Tirrill regulator controlling the exciter field circuits.

SWITCHBOARD.

The main switchboard is made up of marble slabs carrying Westinghouse instruments and switching apparatus. It contains four panels for the operation of the generators, three panels for the control of the exciters, two panels for the Tirrill regulators, one load panel, one inclined station panel for the synchroscope and alternating-current voltmeters, and five panels for the apparatus controlling the outgoing feeder system and the local high-tension circuits.

Each generator panel is equipped with instruments indicating the current per phase, the power factor, the watts, and the field current. Receptacles are also provided on each generator panel for making connections with the synchroscope and the voltmeters on the inclined panel. This panel contains the main field switch and rheostat hand wheel, together with an electric governor controller for changing the speed of the generators from the switchboard gallery for the purpose of synchronizing when it is desired to throw two or more generators in parallel. The oil circuit-breakers between the generator and the buses are also electrically controlled from these panels. Watt-hour meters are placed in the bus sections in such a way as to register the total output of the generators or of any group of feeders.

Each feeder is equipped with an ammeter, overload relay and

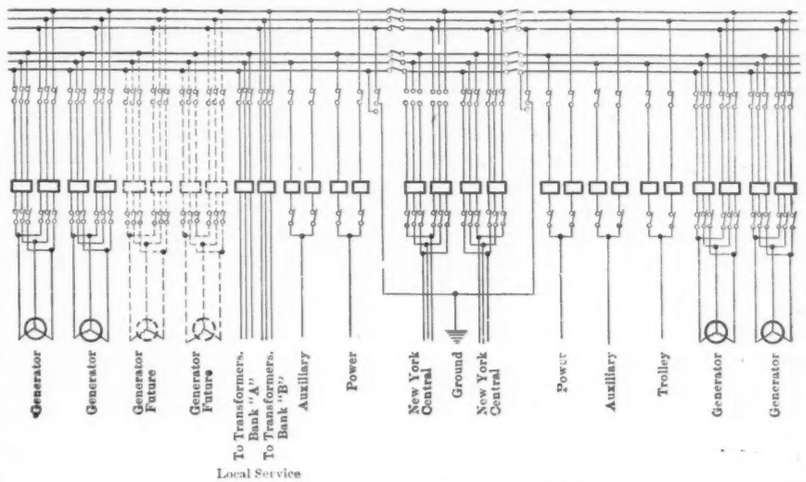


FIG. 8.—DIAGRAM OF HIGH TENSION CONNECTIONS.

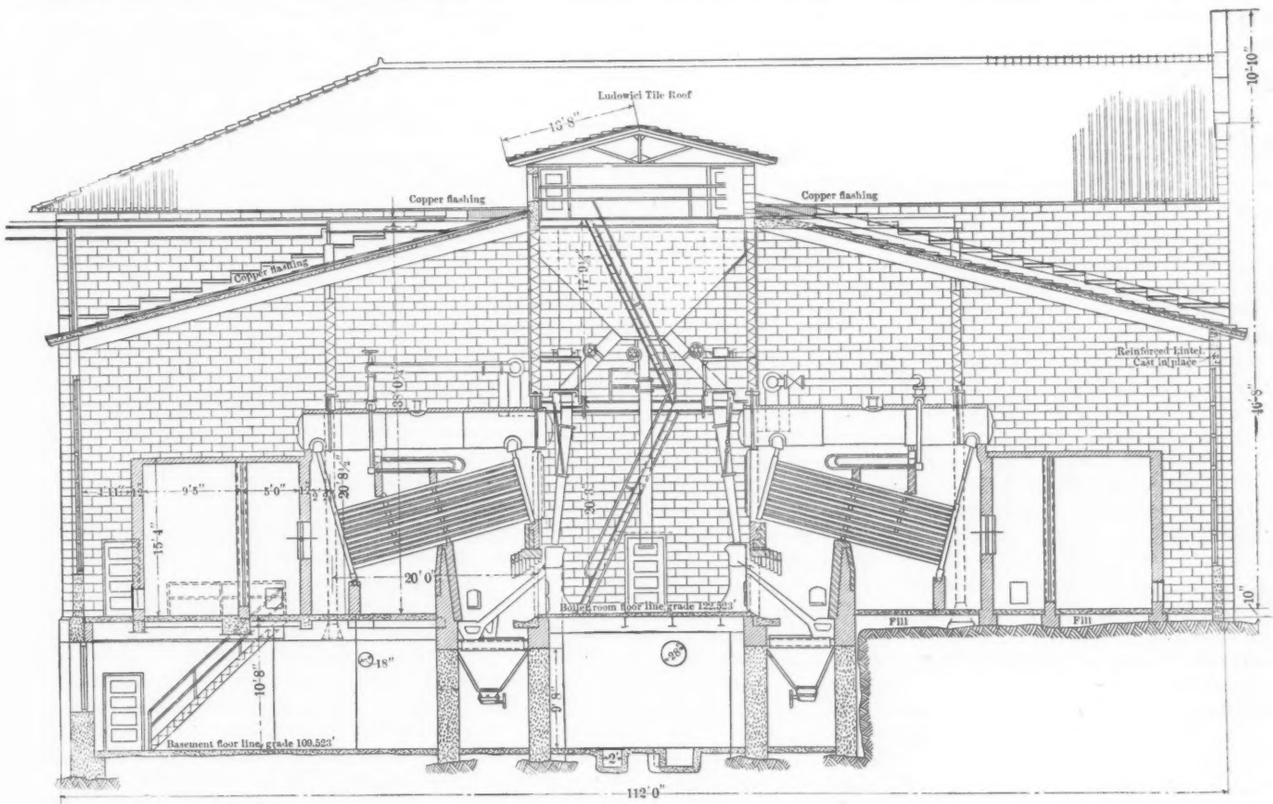


FIG. 7.—CROSS-SECTION OF BOILER ROOM.

controllers for its oil circuit-breakers. Colored lamps on the switchboard indicate the position of the circuit-breakers.

An interesting detail of the switchboard equipment for the feeders is found in the time-limit feature of the overload relay. Each overload relay is shunted by a fuse, which must blow before the fuse can act. The impedance of the fuse is so small compared to that of the relay that most of the current passes through the fuse. It will be seen, therefore, that the relay mechanism as a whole possesses a "time limit" exactly equivalent to a fuse. If for any reason it is desirable to operate without a "time limit," the fuse can be omitted. Moreover, the relay can be reset at any time without inserting a fuse, and yet the apparatus will be adequately protected.

For supplying power to the various motors throughout the station, duplicate sets of two transformers each are used. They are T-connected and supply three-phase current at 440 volts.

For the control of the station circuits a local service switchboard is installed containing apparatus for controlling the motor of a motor-driven exciter, the station lamp circuit, the motor circuit and the storage battery circuit. The storage battery, which is located in the basement below the switchboard gallery, consists of 55 cells of the Westinghouse Machine Company's type of 10 amps., rating for 8 hours, and is used for operating the control circuits of the circuit-breakers and the switchboard signal lamps. The battery is charged through a Cooper-Hewitt mercury converter, taking current from the alternating-current lighting circuit.

Cooper-Hewitt mercury arc lamps are used for general illumination and incandescent lamps for restricted locations. Alternating current for these lamps is supplied by duplicate single-phase 75-kw transformers delivering current at 115 volts.

The turbo generators and the exciters were assembled in place by the Westinghouse Electric & Manufacturing Company.

The power plant was designed and constructed under the administration of Vice-President McHenry. The regular engineering facilities of the road were supplemented by the services of Westinghouse, Church, Kerr & Company, who were associated in the design of the plant, and who, in behalf of the road, erected the building, and, except as before stated, installed the equipment.

Luminous Arc Lamps from the Standpoint of Central Station Operation.

A paper presented by Mr. Howard Grabhill at the recent Toledo convention of the Ohio Electric Light Association gave some interesting data concerning the commercial operation of luminous-arc lamps at Ashland, Ohio, during the past two years.

In comparison with the open arc lamps, which were used formerly, the luminous-arc lamp gives a better distribution of light, a better quality of light and experiences fewer "outages." Moreover, it is more economical in electricity consumption, permits of greater ease of adjustment and of trimming, and entails a lower cost for maintenance, repairs and renewals.

With the magnetite lamp the light distribution is more uniform than with the open-carbon arc lamp. A globe with a frosted or sand-blasted bottom is used, and there is almost no shadow beneath the lamp. Two things make possible the better light distribution of the magnetite lamp. First, the positive electrode does not form a crater as does the positive carbon of an open-arc lamp, resulting in the axis of maximum distribution being at an angle of about 45 per cent. And, second, the arc in the magnetite or luminous-arc lamp always has the same relative position, so that it is possible to use a reflector. This reflector is placed in a horizontal position just above the arc, but being of enameled iron it is unaffected by the heat and hence is not a part that would need to be renewed during the life of the lamp. The result is that the axis of maximum distribution of this lamp is at an angle of about 90 per cent, or almost horizontal. As the streets of Ashland are quite irregular and there are many shade trees on some of the residence streets, the better light distribution of the magnetite lamp is quite noticeable, and it is appreciated by at least a part of the citizens. Moreover, the quality of the light is excellent, being whiter than alternating-current lamps and steadier than open-carbon lamps.

Another advantage which this lamp has is that of fewer outages. When a lamp is found not to be burning it can usually be started by jerking the rope by which it is raised and lowered. The stoppage is caused by a small particle of the burnt electrodes getting between them and acting as an insulator. It has been found necessary to replace broken globes at once, as this lamp will not burn unprotected from the air. This is not a serious defect, as the long burning feature of the lamp makes frequent trimming or handling unnecessary; hence the chances for broken globes are reduced. Moreover, it is believed that a city has a right to expect the lighting company to keep its globes in repair, whether the lamps used be open carbon, alternating current or magnetite lamps. The ratio of outages as compared with the carbon lamp has been one to three in favor of the magnetite lamp.

The low wattage of the magnetite lamp is one of its most distinguishing characteristics. It is designed to operate on direct-current series circuits with from 70 to 80 volts at the lamp terminals or by mercury arc rectifiers connected to alternating-current circuits. In Ashland the direct-current system is used, energy being furnished by a Brush arc machine. The replacing of a 480-watt lamp with one consuming 320 watts has been found to be a great benefit to the company.

Because of the long burning feature of this lamp, the maintenance cost, as compared with open-carbon lamps, is very low. The upper or positive electrode, a heavy piece of copper, is reversible and has a life of about 4000 hours. The lower electrode, an iron tube, 5/8 in. in diameter and 8 ins. long, and filled with black magnetic oxide of iron, has a life of 175 hours. It is thus necessary to trim the lamps only nine times a year. The cost of maintaining these electrodes on the midnight schedule is about 60 cents per lamp per year.

The two adjustments, the length of the arc and the feed contact magnet, are easily made. The length of the arc is controlled by an adjustable stop which is fastened by a set screw to the left hand guide rod. To increase the arc voltage, raise this stop; to decrease the voltage, lower it. After an adjustment has been made the lower electrode rod should be tripped and then pushed up as in trimming. The feed contact magnet is adjusted by lowering or raising the armature disk and checknut placed just below it. If the lamp feeds too often, the disk should be turned to the left. If not often enough, it should be turned to the right. This magnet is in shunt with the arc and should close the contacts, causing the lamp to feed, when the arc voltage rises to about 110 volts.

In trimming the lamp, the first thing to do, after the globe has been unlatched and swung over to the side, is to clean the center tube, which serves as a chimney through which the fumes of the arc pass out of the lamp; unless the tube is kept clean there is danger of the reddish-brown fumes accumulating in it and clogging it up and settling on the inside of the globe and shutting off the light. A small brush run through this tube a few times readily cleans it. Next the globe should be cleaned. The accumulation of the reddish-brown dust on the globes, from one trimming to the next, while slight, is sufficient to cut off considerable light. It is, however, easily removed with a cloth dampened with coal oil. To replace the burned-out electrode, the tripping rod should be pushed up until the clutch in the lamp is disengaged. The lower electrode holder will then drop into a position where the change is quickly made. To those who have had the experience of trimming the open-carbon lamps, the ease with which the magnetite lamp is trimmed is at once apparent.

Repairs and renewals cost last year 54 cents per lamp. With the latest type of lamp it is believed that this item will not be so large, because it has a heavier globe and does away with a large copper ash pan, and these were the only two parts requiring replacement during the year. For the present year.

however, this item will be larger on account of changing to the new type of lamp.

As a whole, the system comes fully up to the lighting company's expectations and is regarded as the best in operation at the present day.

What Is the Best Form of Power for Stations of Five Hundred Kilowatts or Less?

In a paper presented at the recent Toledo convention of the Ohio Electric Light Association, Prof. F. C. Caldwell stated that for small stations there are now available the following types of apparatus: Direct-current, two-wire, 220-volt and three-wire, 110-volt; also, alternating-current, single-phase or polyphase. The choice between these will depend, first, on the character of the load to be supplied; second, upon the size of the plant, and, third, upon the conditions under which it will be operated. A few years ago the two-wire, 220-volt, direct-current system seemed likely to take an important position for the smaller central station supply. Two factors, however, have recently been introduced into the problem, both of which are unfavorable to its growth. The first of these is the development of metallic filament incandescent lamps. The low resistivity of metals, as compared with carbons, makes the extension of these to voltages as high as 220 seem improbable, while the great saving in energy, resulting from their use, dare not be overlooked. The other factor is the placing on the market of successful three-wire generators at a cost not greatly in excess of the standard type. The 220-volt system has never been much used in this country outside of the smallest plants, though its simplicity and comparative economy in distribution were strong arguments in its favor. It will doubtless continue to be employed in cases where transmission for power purposes is the main business; but where lighting is an important element, it is probable that it has passed its period of greatest usefulness. The problem may, therefore, be narrowed down to a question of three-wire direct current versus alternating current, single-phase or polyphase.

As between the direct and alternating current, this question of distribution of load is the most important factor. Wherever more than one town is to be supplied with energy from the same plant, or where the character of the farming population is such as to make the sale of energy for lamps and motors among them a matter of importance, the decision must be in favor of alternating current. On the other hand, where the conditions seem to set definite and comparatively narrow limits to the area over which the plant will supply energy, the greater simplicity, higher economy in distribution and superior regulation usually obtained from direct current plants, may determine in favor of this form of supply. The amount and character of the motor load must be given careful consideration. If this is large in the immediate vicinity of the power plant and especially if variable speed is important, the direct current will have the preference. If, on the other hand, the demand is more widely scattered, or is of such a nature that the simplicity and brushless character of the induction motor recommend themselves, the decision may be favorable to alternating current. The use of the storage battery in connection with the direct-current system gives it an advantage. In some cases, for instance, it may be possible to supply direct current for 24 hours with the use of only one 10 or 12-hour shift, at the same time obtaining the great advantages in the matter of regulation and storage against an emergency shut-down which are provided by the battery. Such a use of the battery, however, would only be possible in cases where the motor load is negligible, a condition which is in itself unfortunate. In general also the small plant is unable to supply the same quality of expert attention for the battery as is possible in larger stations, and this would often make its use questionable. In the case of very small stations, such as are now being installed to a considerable extent in the villages of the country, the use of an alternating-current system with a frequency of 25 cycles should receive careful consideration. This would often be advantageous on account of the possibility, actual or prospective, of joining up such a plant with the 25-cycle distribution system of some interurban electric railway. Ample experience has demonstrated the satisfactory operation of incandescent lamps with 25-cycle current, and in almost every case it would be more economical to purchase energy from railway systems during a considerable part of the 24 hours rather than to keep the generating plant operating continuously. In many cases the whole output of the station could be most advantageously obtained in this manner. This suggests the supplying of energy from one plant to a number of small towns throughout a given district, a field which deserves more energetic cultivation than it has yet received.

The question of the use of single or polyphase alternating current is also an interesting one. Single-phase motors are obtainable in small sizes running up to about 30 horse-power, so that where the supply of power in large units is not to be anticipated, as, for instance, in the case of a strictly farming community, much is to be said in favor of the greater simplicity of the single-phase. Especially is this true in the case of the smaller plants where it is not practicable to employ a superintendent who has had much training or experience. In the case, however, of the larger plants within the range under consideration, especially if connection with an electric railway supply circuit is considered, the polyphase system should probably be used. With a little more care in distribution, just as good results can be obtained as with the single-phase, and the possibility of the use of larger motors is always present.

With reference to prime movers, Prof. Caldwell made the following classifications: I. Water power; II. gas power—natural gas, producer gas; III. steam power—reciprocating engines, turbines.

With regard to water power, nothing need be said, further than to predict that before many years energy will be developed in Ohio by water power at a greater rate than is now done. It is a very interesting problem, but, of course, peculiar to special localities only.

Where natural gas is available, there is hardly room for any further discussion of this subject, so far is the gas engine thus operated superior to all other forms of heat engines. With a thermal efficiency approximately double that of reciprocating steam engines, with the entire absence of loss when the engine is not running and with the great rapidity with which it can be brought into operation, no form of steam engine is to be compared with it for small plants. The complication and liability to accident and shut-down which have been in the past attributed, with more or less justice, to the gas engine, have of late been rapidly losing weight by virtue of improvements in design and greater familiarity on the part of engineers. In the case of small plants for lighting or power purposes, the defect of the gas engine in not having a considerable overload capacity is not so serious as in other lines, although it must be taken into account in the design of the plant.

In the absence of either water or natural gas, the producer and gas engine plant is in free competition with the various forms of steam engine, with a strong indication that the odds are coming to be more and more favorable to the former. Here success depends entirely upon the producer, which seems satisfactory in the case of the harder coals. In Ohio, however, the producer must demonstrate its ability to handle the bituminous coals of the state before it can be generally accepted as a substitute for the steam boiler. Its friends already claim the victory and when account is taken of the relative time that has been spent in the development of the producer and the boiler, those who have been devoting themselves to the former certainly deserve congratulation. With a producer working successfully with soft coal, the steam engine will, indeed, have to look to its laurels, for the possibility of getting nearly twice as much energy from a ton of coal, together with the small standby losses and the quick service, give the gas engine enormous advantages against which the somewhat lower first cost

and the long standing reputation of the steam plant cannot long prevail.

Steam is, however, still with us and doubtless will be for some time to come. Thus far, the great development which the turbine has induced in the case of the larger stations, has not been much felt by the smaller. Although at present turbines in a variety of smaller sizes are available, their use does not show as great an advantage over the reciprocating engine as in the large sizes; generally speaking, also, in the case of the small station, economy of space is not so vital a matter as with the large city plant. On the other hand, the simplicity of the turbine should be a matter of even greater consequence, so that the question of relative first cost would probably be a determining factor in most cases. Of course, wherever condensing water is available in ample quantity, anything but the very smallest plant should be operated with compound condensing machines. The availability of condensing water would also be important in determining the use of turbines. The question concerning the use of artificial means for the cooling of condensing water is a financial one, and depends largely upon the price of coal, the cheapness of which in Ohio would seldom permit of the use of this system. Another factor which should always receive consideration and which may at times determine the character of the steam plant, is the sale of exhaust steam for heating purposes. The jacket cooling water in a gas-engine plant may be similarly used.

In the case of small lighting and power plants, their combination with some other form of industrial activity should be given consideration. In many cases, a power plant may be made to pay if during the daytime the energy of the plant can be consumed in the operation of some productive industry. This works out especially well where the industry is of such character that a part at least of its machinery can be closed down an hour or two earlier during the winter months without seriously interfering with its success. A combined electric and pumping plant is a similar case. This is an especially desirable arrangement, if water storage is available, so that the pumps can be entirely shut down during the period of peak load. In this connection the electrically-driven centrifugal pump which has recently come before the public ought to prove useful.

New Telephone Patents.

NEW SWITCHBOARD SYSTEMS.

In all common battery systems the function of the battery in absorbing the irregularities of the charging machine current is well understood, and to obtain the full advantage of this it is customary to connect all leads so that the battery is actually between the generators and switchboard. An entirely opposite arrangement is now proposed by E. E. Clement, of Washington, D. C. He connects the battery to all line circuits permanently through individual retardation coils, while the machine is connected to all cord circuits. It will be understood, then, that whenever a cord is plugged to a line, the generator supplies current to the line and also through the coils to the battery. This will keep the battery charged and the inventor claims will provide for an absorption of the generator noises. This latter claim, however, seems to have little foundation, if we are to judge from usual experience, as retardation coils of sufficient size to prevent a shunting of the talking currents by the battery must certainly back up into the line a large part of the noise.

Relays connected in a talking circuit have for a long time been provided with a comparatively high-resistance, non-inductive shunt to prevent undue attenuation. Now C. S. Winston, of Chicago, has introduced the same arrangement on relays whose circuits are abruptly opened to absorb the coil discharge, and thus prevent this from causing undesired operation of the apparatus connected in its circuit. For example, where a locking relay is in the circuit, the unabsorbed kick of a relay in a branch of the circuit may overcome the locking coil current. Mr. Winston has assigned his patent for a shunted combination of this sort to the Kellogg Switchboard & Supply Company.

H. P. Claussen has patented two circuit inventions, which are assigned to the American Electric Telephone Company. One of these relates to the busy test of a two-wire system, and provides a retardation coil in the test circuit. This coil holds back the current of the test so as to prevent any annoying clicks upon the lines tested. It has the further function of preventing any leakage of the talking currents of busy lines to the test circuit. The other patent describes a system where both magneto and central signalling lines are used. A repeating coil may be cut in or out of circuit according to whether the lines connected are similar or dissimilar.

PARTY-LINE SYSTEMS.

A. J. Fanner, of Detroit, Mich., has invented apparatus for party stations working upon the group system. The lines from the various stations are brought to a control point, where the group switching apparatus is placed. From this point the main line extends back to the central office. The operator can control the distant switching apparatus to connect up the various stations as desired. This is accomplished by a step-by-step action which rotates an arm over a contact dial. The stepping action takes place automatically in response to a steady pressure upon a special key. Each step is indicated by a signal lamp before the operator. After a conversation, the pressing of another key advances the switch to the zero position.

A lock-out system forms the subject of a patent granted to D. W. Kneisly, of Dayton, Ohio. The lock acts upon the hook switch lever at each station, the lock lever at each station being released by a certain number of steps forward of the controlling bar. Normally the locks clear the hooks, but the first step of the bar locks up the line, the desired station then being released by further motion of the moving bars.

MISCELLANEOUS DEVICES.

A pole cable terminal has been patented by E. C. Flory, of Santa Barbara, Cal. This provides a sealed compartment, two of whose faces are of insulating material upon which binding posts are mounted. A smaller internal compartment having a perforation serves as a cable entrance, and after the cable is in position, may be filled with sealing compound. The terminal is arranged on a circular base and is provided with a cylindrical sheet-iron cover.

In order to close the opening of a transmitter to shut out all sound at will, H. Gross, of New York City, has mounted his transmitter mouthpiece upon a slide. This slide moves across the transmitter face so as to close the opening, or to maintain the mouthpiece in front of it as desired.

Letters to the Editors.

Telephones for the Partially Deaf.

To the Editors of Electrical World:

Sirs:—In your issue of Aug. 10, you refer to a miniature telephone receiver, recently produced and now being experimented with in Stockholm, Sweden. The statement made as to its adaptability as an aid to the deaf prompts me to make several statements of fact, in that connection, that may prove of interest and perhaps of some value, in view of my work in the production of instruments for the deaf, now in common use, and to which I devoted seven years of effort.

Owing to the supersensitiveness of the deaf, a device to meet with their approval must necessarily be inconspicuous. Unfortunately there is an element which enters here that places a limit on the diminutiveness of the ear piece or receiver, and that element is the surgeon's knife

Several years ago I constructed a diminutive receiver, only one-quarter of an inch in diameter, and five-sixteenths of an inch long. When introduced into the external meatus, the diaphragm being one-quarter of an inch from the tympanic membrane or drum of the ear, the results were astonishing. The flesh-colored flexible cord leading out and connected to a

transmitter and a small dry battery concealed on the person, completed the outfit. The deaf man on whom I was experimenting was happy, but he did not remain so very long. He went to the hospital and came out minus a part of his skull, from a mastoid operation.

Other efforts toward concealing the receiver within the ear, and even with models constructed with front conical projections barely entering the meatus, caused a recurrence of the same symptoms that existed prior to the operation on the other subject above referred to.

Many materials were tried, with a view toward arriving at a combination such as would not cause irritation. My efforts were of no avail, and I eventually adopted the watch-case receiver type, necessitating its being held against the concha of the ear by the hand or small head band.

There is an old medical axiom for which I have a great deal of respect—"Nothing smaller than one's elbow should be introduced into the ear." There are many so-called "ear drums" advertised, intended for insertion into the ear. They cost a very small amount to purchase and for insertion, but on the other hand, the revenue of aurists is greatly enhanced by *removing them*, and many times in a big hurry.

The ear resents the presence of foreign material very much as does the eye, although in a slower and more dangerous manner. The brain and ear are not far removed from each other. Inflammation of the ear is quickly communicated to that of the mastoid portion immediately behind the ear. Once this becomes affected, it is very apt to mean a serious operation to prevent death. I therefore feel that any experiments along this line should be entered into with a full knowledge of the conditions obtaining.

As to the value of the device described, to a telephone operator in a central station, I am of the opinion that, aside from the inflammatory effect above referred to, there will be found another element which enters here. In such a receiver, there is a closed air column between the diaphragm of the receiver and the drum of the ear. We have all experienced the painful "clicks" to which we are sometimes subjected in the use of the ordinary telephone, often necessitating instant removal of the ear piece from the ear. The ordinary watch-case receiver diaphragm is removed considerably from the tympanum and this effect is considerably less than would obtain if a receiver is inserted into the ear.

It will be found by our friends across the sea that the receiver is the simplest part of an instrument for the deaf. It is the transmitter that is the key to the situation. One to be of value to the deaf must amplify in inverse ratio. The faint articulate sound of words must be amplified much more than the vowel sounds, which latter the partially deaf person already hears. An instrument which will amplify in direct ratio will so overload the ear with sound as to render appreciation of the articulation impossible. For instance, the proper transmitter when ***whispered*** into, should operate at its maximum, and when ***shouted*** into, not operate at all. As the speaker recedes from the transmitter, this ratio is not so great, but with the result that spoken words at a distance are distinctly heard by the deaf person.

There are many other elements which enter into the design of an aid for the deaf, such as sluggishness of the small bones that transmit the sound from the ear drum to the oval window, all of which would render this letter too voluminous; but I shall be glad at some future date to contribute an article bearing on this subject.

My efforts in this direction were interrupted before I had arrived at what I considered a perfect machine, so there is room for improvement. Experimenters entering this field should, however, remember that a fairly good knowledge of medicine is necessary to produce the best results, and that no one device or one adjustment of instrument can be expected to meet with universal success. Such devices should be fitted to the ear as are eye glasses to the eye, and not until this is done intelligently *and by experts*, can the deaf expect to receive benefit from a panacea for their affliction.

NEW YORK. MILLER REESE HUTCHISON.

Instruction in Illumination for Architects.

To the Editors of Electrical World:

SIRS:—In view of a statement in an editorial of your issue of July 27, namely, "We are not aware of a single course in illumination given to students of architecture anywhere in the world," I trust that the accompanying marked copy of the current catalogue of the University of Illinois will be of interest. As you will see from it, a short course for all students in architecture and in architectural engineering is given at the University of Illinois, described in the catalogue as follows: "Lighting—For architects. Electric lamps and other illuminants, and their effective use. Interior wiring. Methods of electrical distribution." This course has been given regularly for the past five years, and covers illumination for utility, for decorative effect and for advertising. It also includes a discussion of prismatic glass and the relation of the location of day to evening light sources. The students are urged to introduce raceways for wires in any building they may design, and are required to report on some actual installations, noting any infraction of the Underwriters' Rules. Demonstration of lighting by different types of lamps is given in the "Illumination Room" of the electrical department, where the proper lighting of pictures is also discussed. The course should occupy more of the architectural students' time, and will probably be strengthened now that interest is growing in all matters relating to illumination.

UNIVERSITY OF ILLINOIS. MORGAN BROOKS.
Professor of Electrical Engineering.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors, and Transformers.

Alternating-Current Motors.—H. GOERGES.—The conclusion of his paper read before the German Association of Electrical Engineers on the theory of all alternating-current motors discussed from a common point of view. The explanation of the action of single-phase and polyphase alternating-current motors is based on a resolution of the induced magnetic flux in the rotor into two components in electrical space quadrature to each other, of equal frequency, but differing in amplitude and phase. If the winding of the rotor is also imagined to be resolved into two windings the axes of which are in the direction of the above components, two e. m. f.'s occur in each of these windings, their amplitude and phase being determined by the components of the magnetic flux. The currents are divided into free, unfree and forced ones, and are determined from Ohm's law. By combining the currents with the magnetic fluxes, two torques of double frequency are obtained which always produces in single-phase motors a pulsating total torque. This theory is applied to the four main types: induction motors, series motors, series short-circuited motors and repulsion motors. The direction of rotation is found from the torque at rest, and the behavior of the motor while running is then discussed. Finally some notes are given on general problems concerning voltage, size and weight, capability of regulation, commutation and frequency. In the same issue an account is given of the extended discussion which followed this paper, and also of the discussion of some other papers on single-phase motors (the other papers themselves being not yet published). In this discussion, in which Eichberg, Heyland, Richter, Schueler, Breslauer and Sahulka participated, the

relative advantages and disadvantages of the different new types of single-phase commutator motors were discussed. Goerges thinks that each type will find its own field of application.—*Elek. Zeit.*, Aug. 1.

Single-Phase Motors.—W. Cramp.—An account of the result of tests of his single-phase motor, which is diagrammatically shown in Fig. 1, where *A* and *B* are the two limbs

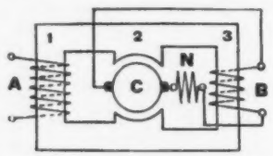
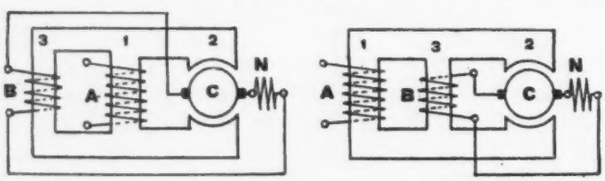


FIG. 1.—DIAGRAM OF SINGLE-PHASE MOTORS.

of the motor, *C* the armature. On the limb *A* is wound a coil connected to the supply mains. By transformer action the coil on the limb *B* supplies current to the armature *C*, which may or may not have a neutralizing coil *N* in series with it. The results of the tests, which are given in diagrams, show that such a motor has characteristics of speed, torque, current, voltage, very similar to those of a series motor, and that with constant terminal voltage, the primary current may be expressed by a circle diagram very similar to that of the induction motor. Besides the form shown in Fig. 1, two other forms are possible, which are shown in Figs. 2 and 3. Of



FIGS. 2 AND 3.—OTHER FORMS OF SINGLE-PHASE MOTORS.

these three forms the author thinks Fig. 2 to be the best one, its advantage over Fig. 1 being that the iron between limbs 1 and 2 does not have to carry the flux due to limb 3, so that this form may be constructed lighter and more compact than that of Fig. 1. The differences between such a machine and a series motor are mainly, first, in the armature turns required for a given terminal potential difference and, second, in the section of yoke ring required. With respect to the first point the comparison is to the disadvantage of the series motor; with respect to the second point it is to its advantage.—Lond. *Elec. Rev.*, Aug. 9.

Lamps and Lighting.

Flame-Arc Lamps.—A. Blondel.—The conclusion of his serial on recent progress in flame-arc lamps. The author first gives some notes on the obnoxious fumes (nitrogen, oxides, etc.) developed in the lamp and on the methods of avoiding them, also on the reduction of the potential drop in the electrodes and on the quality of the light of flame arcs. Tables are given summing up the principal properties of different direct-current and alternating-current arc lamps made in Europe, especially current, volts, watts, candle-power, specific power consumption in watts per candle-power, and consumption of the electrodes. From these tables it appears that the chief merit of the impregnated carbons is the realization of small candle-power lamps with a good efficiency. It is possible to go down to 3 amperes and 55 volts, although the light then becomes somewhat unsteady and more red in color. Lamps consuming a greater amount of power have a more steady and whiter light; lamps of 250 or 300 watts for direct current or 350 or 400 watts for alternating current are specially recommended for public lighting. Some tests are quoted which have been made in a French laboratory. For impregnated carbon arcs, supplied with direct current between 6 and 8 amperes and between 27 and 33 volts the luminous flux in lumens is given as function of the current i in amperes and the voltage V by the following empirical formula: lumens $= (34.3\ i + 610)\ V + 1550\ i - 25{,}146$. For example, with 7 amperes and 33 volts, corresponding to about 230 watts, the luminous flux is 13,750 lumens, the mean spherical candle-power being 10,900. For alternating currents between 12.5 and 16.5 amperes and between 28 and 36 volts, the corresponding formula is: lumens $= (222.5\ i - 1873.5)\ V - 4460\ i + 45{,}809$. For example, with 14 amperes and 30 volts, corresponding to about 400 watts, the flux is 20,000 lumens, the mean spherical candle-power being 15,900. The latter lamps are used very satisfactorily for lighting a Paris street. The flame-arc with carbons impregnated with calcium salts, consumes between 0.1 and 0.25 watts per hefner candle; that is, about one-fifth or one-fourth as much as arcs with pure carbon and one-third or one-half as much as mercury-vapor arcs. While with the ordinary arc the source of light is an incandescent disk (crater), partially obscured by the negative carbon, the source of light in the flame arc with impregnated carbons is a vertical luminous cylinder below a diffusing disk. The flame arc is far more favorable for lighting of large spaces. By giving the reflector a special form the distribution of the light may be modified. The author thinks that the flame arcs with impregnated carbons will replace the open arcs in Europe, while the titanium arc will replace the enclosed arcs in the United States.—*L'Eclairage Elec.*, July 13.

Influence of the Surrounding Temperature on the Candle-Power of Incandescent Lamps.—F. Laporte and R. Jouast.—An account of laboratory experiments in which the authors investigated whether the temperature of the surrounding air has a measurable effect on the candle-power of an incandescent electric lamp. An incandescent lamp consuming about four watts per candle was fixed in a stove with a transparent side. A photometer was placed at a certain distance from the stove, and equal illumination was obtained on its screen by moving the standard lamp. Great precautions were taken to maintain the voltage across the lamp terminals constant, a potentiometer being used for this purpose. In order that the variation of temperature should have no influence on the resistance of the contacts, both the main and voltmeter wires were soldered direct to the lamp terminals. The candle-power of, and the current through, the lamp were measured under the following conditions: (1) With the stove cold, at a temperature of about 15 degs. C.; (2) during the heating of the stove; (3) with the stove at a constant temperature of 115 degs. C.; (4) during the cooling of the stove; (5) with the stove completely recooled at a temperature of about 15 degs. C. The candle-powers measured were found to be practically constant, the greatest variation between the extreme readings not exceeding 1 per cent. From the Stefan-Boltzmann law it is deduced theoretically that the candle-power would increase 0.4 per cent per 100 degs. of temperature variation, which would not have been observable with the experimental conditions of the investigation of the authors.—Lond. *Elec.*, Aug. 9.

Traction.

Electric Railway in Spain.—The Company of Railways in southern Spain intends to operate electrically, as a trial, a branch line 22 km. in length, of the railroad between Linares and Almeria. This branch line, which has an almost constant grade of 2.75 per cent, is single-track and with steam traction the disadvantage is now experienced that the trains running down hill can run only at low speed. When the freight traffic increases on this line, improvements are expected from electrical operation. To recuperate energy when running down hill, three-phase currents will be used, and a double trolley line is provided for this purpose, the voltage being 5500. Electric locomotives will haul trains of 150 to 300 tons at a speed of 25 km per hour. For the trial, electricity will be obtained from a steam-generating station, but if the experiment is successful, the whole line will be equipped electrically and water powers along the line will be developed.—From *Schweiz. Bauzeit*, Vol. 50, 1907, page 26; abstracted in *Elek. Zeit.*, Aug. 1.

Storage Battery Traction.—E. C. Zehme.—On specially selected lines of the Palatian railways, storage battery cars have proven quite satisfactory since 1895; they are now used

there on lines having a total length of 135 km. The success is due primarily to a careful selection of the lines on which this system is used. The equipment of these storage battery cars is described and illustrated. They are used only in such districts where the railways have their own generating plants, so that cheap energy is available for charging the batteries. The Prussian-Hessian railways are also now installing storage-battery cars for suburban traffic near Mainz. Each of the smaller cars will contain 180 cells of 10 tons total weight while each of the larger cars will contain 180 cells of 15 tons weight. The axles will be driven by means of two series motors in the usual way. The following estimate of cost is given. For the generation of 200,000 kw-hours with Diesel engines the cost per kw-hour including interest and amortization is 1.25 cent. No special attendance is assumed, since the motorman will attend to the charging of the batteries at the station. The consumption of 200,000 kw-hours per year relates to a distance of 180,000 km covered per year by the five cars, so that each car is assumed to travel 36,000 km per year. The cost of maintenance of the storage batteries is assumed as 2 cents per car-km. The total cost of operation is 8.75 cents per car-km, including interest and amortization. With the new cars which contain 100 or 110 passengers the total cost is estimated as 12½ cents per car-km. so that if the tickets are sold at one-half cent per km, the income will cover the expense even if only one-fourth of the seats are filled. The life of the positive plates is assumed as 120,000 km, that of the negative plates 80,000 km.—*Elek. Zeit.*, Aug. 8.

Surface Contact System.—The report and accounts for the Lincoln municipal tramways, which is the only line now working on the "G. B." surface contact system (to be used on a trial line in London), show working expenses of 13.396 cents per car-mile, not including capital charges, a figure which is brought up to 22.224 cents per car-mile by the inclusion of all capital costs. The line is less than two miles in length, and the car mileage is smaller than for any other municipal tramway system.—Lond. *Elec. Eng'ing*, Aug. 1.

Current Collecting Device.—An illustrated description of a new form of current collecting device for overhead electric railways of the British Thomson-Houston Company. Contact is made with the trolley wire by a number of bars, and a means of adjustment is provided at right angles to the trolley wires, so that as the grooves are worn into the bars they can be shifted lengthwise, and the wear can thus be distributed over the whole surface.—Lond. *Elec Eng'ing*, Aug. 1.

Electric Traction on Railways.—P. Dawson.—The third article of his paper on electric traction on railways. In the present instalment he gives remarks on choice of acceleration and motors.—Lond. *Elec.*, Aug. 9.

Rail Corrugation.—W. W. Beaumont.—A paper read before the British Association for the Advancement of Science on the origin and reduction of the corrugation of tramway rails.—Lond. *Elec. Eng'ing*, Aug. 8.

Wires, Wiring and Conduits.

Submarine Cables for Electric Transmission.—An account of a case of the transmission of electrical energy at high pressure through submarine cables. The cables in question form part of the line connecting Venice with Lido. This line is partly overhead and is supported on insulators fastened on iron trellis-poles which are fixed in cement foundations; but as it has to pass across several navigable canals, it is necessary that a part should be submarine. The longest submarine section is somewhat over half a mile, and is laid at a depth of about 3½ fathoms. Energy is transmitted by three-phase currents at 6200 volts and a frequency of 42. Three single cables are used to allow of greater flexibility. A fourth cable is laid which provides against possible damage due to blows from anchors, etc. The cables used are constructed with a new type of insulating material, having gutta-percha as a base. Over the core, which is 25 sq. mm. in section, are wound two layers of insulating material of different compositions. These are protected against damp by a lead sheath, which is covered with tarred jute and with an armoring of phosphor-bronze wire. This system was chosen in order to diminish the loss of energy due to eddy currents and hysteresis.—From *Ellettricista;* abstracted in Lond. *Elec.*, Aug. 2.

Electrophysics and Magnetism.

Constitution of Atom.—E. Rutherford.—A paper read before the British Association for the Advancement of Science. The author reviewed the development of the conceptions of ions and electrons. While the electron is the unit of negative electricity, there is much speculation as to the nature of positive electricity; some regard a positive charge as a sort of cement to hold electrons together in the atom. As the smallest negative charge that can exist is that of the electron, so it is probable that the smallest positive charge corresponds to that of the whole hydrogen atom. It is doubtful whether the whole mass of the atom can be explained electrically. The author does not think that much help will be derived in the future from spectrum analysis in the elucidation of these problems, since it is probable that the bright lines in the spectrum are largely due to electrons superficially attached to the atom, and not to the actual electrons forming its internal structure. The real spectrum from these probably lay far away in the ultra violet direction. In the discussion which followed Sir Oliver Lodge spoke as one of the champions of the electrical theory of matter. Mass and inertia can probably be explained by consideration of the magnetic field set up by the motion of the charge. Radiation can be accounted for by the fact that a charge, when accelerated, must radiate energy and throw the ether into waves, and for this it is not necessary to assume a compressible ether. Sir William Ramsay said that what interests chemists more than the internal construction of the atom is the detachable electrons upon which the valancies probably depend. F. Soddy took a contrary view to Sir Oliver Lodge, and said that he had difficulty in making all the work of the theorists agree with recent experimental results and could not bring himself to regard matter as purely electrical. Prof. Schott, in the course of his remarks, spoke of difficulties in reconciling the large number of lines in metallic spectra with the small number of superficially attached electrons postulated by some authorities. Lord Kelvin spoke at some length, and again referred to his abandonment of the theory that elasticity could be explained by motion alone. He did not agree with the view that the internal energy of the atom was entirely kinetic, and considered it was more of a potential or static nature.—Lond. *Elec. Eng'ing*, Aug. 8.

Short Sound Waves Produced by Spark Discharges.—W. Altberg.—The shortest sound waves hitherto produced by acoustic means were those produced by Koenig with tuning forks, and by Edelmann with a Galton whistle. The wave length of the former was 3.8 mm. and of the latter 2 mm. Lodge, on the other hand, produced audible notes by means of condenser discharges through large inductances. The present author used this method for obtaining the shortest possible sound waves, and measured their lengths by means of diffraction gratings. The shortest wave-length which the author succeeded in measuring was 1 mm. which is an octave higher than Edelmann's shortest.—*Ann. d. Phys.*, No. 7, 1907; abstracted in Lond. *Elec.*, Aug. 9.

Helium in Common Ores.—R. J. Strutt.—An abstract of a paper read before the British Association for the Advancement of Science. It is now recognized that the origin of the presence of helium in many minerals is due to radioactive changes and the author has investigated whether helium can be found in certain common minerals which are not known to contain even traces of radioactivity. He has been able to find traces of helium in almost all metalliferous ores and strong minerals. Concurrently with the helium determination, the quantity of radium was also determined by well-known methods, and it was found that the quantity of radium present is in almost all cases sufficient to explain the helium without postulating its production with the small radioactivity which there has been

reason to associate with common elements.—Lond. *Elec. Eng'ing*, Aug. 8.

Resonance Transformers.—A. Blondel.—An English translation of his French paper on the discharge of condensers charged by transformers and on the regulation of resonance transformers. The author investigates the conditions determining the nature of the secondary discharges.—Lond. *Elec.*, Aug. 2.

Photoelectricity.—W. F. Holman.—An account of an experimental investigation of fatigue and recovery of the photoelectric current.—*Physical Review*, August.

Hertzian Waves.—W. P. White.—An abstract of an American Physical Society paper on the bolometric measurements of the intensity and damping of Hertzian waves in air.—*Physical Review*, August.

Electrochemistry and Batteries.

Electrolytic Rectifier.—G. Schulze.—An account of an investigation in which he found that for an electrolytic rectifier tantalum is even superior to aluminum as a material for the electrodes. There is no electrolyte in which tantalum fails to show a valve effect. The voltage which the non-conducting layer deposited on the anode is capable of resisting is also much higher, being over 650 in carbonate of soda, 600 in various fluorides, and 70 in concentrated caustic potash. It is best to have the tantalum electrode entirely immersed, as otherwise sparks may pass from the surface of the liquid to the emergent portion. Such sparks show the tantalum spectrum, whereas sparks through the liquid show nothing but the spectrum of the electrolyte. The anode skin is easily formed in the course of a few minutes, and is not much affected by heat. Herein it has a great advantage over aluminum. This advantage is, however, to some extent balanced by the instability of the skin on tantalum electrodes, which is greatly reduced in effectiveness in the course of a few minutes' break of the current. Niobium and vanadium also show a valve effect in all electrolytes, though it does not approach 1000 volts, as in tantalum. Other metals, like Cu in copper sulphate, show a slight action of this kind, but it is not of any practical utility.—From *Ann. d. Phys.*, No. 7, abstracted in Lond. *Elec. Eng'ing*, July 18.

Units, Measurements and Instruments.

Manganin Resistances.—W. Jaeger and S. Lindeck.—Rosa and Babcock have found at the National Bureau of Standards in Washington that their higher manganin resistors show a yearly cyclic change in resistance in the climate of Washington corresponding to the variations of the relative humidity at different times of the year. The amplitude of these variations is about 0.01 to 0.02 per cent, an increase in humidity causing an increase in resistance. According to their own explanation, this phenomenon has nothing to do with the manganin resistor material, but is traced to the swelling of the shellac used for insulating purposes and to the resulting elastic deformation of the resistor wire. The present authors have studied the same matter at the German Reichsanstalt and found that the variations of the resistance due to the shellac if existing at all in the climate of Berlin remain very small. "That resistances wound on lacquered wooden spools are unsuitable for precision work in consequence of the swelling of the wood, has been known for a long time at the Reichsanstalt. For this reason resistors of this type are not given certificates as precision resistors by the Reichsanstalt." The proposals of Rosa and Babcock to overcome the faults noticed in Washington by making the resistance independent of the variations in humidity by coating the resistors with paraffin or by enclosing them in a glass tube are considered undesirable by the present authors. "The formerly much-used paraffin insulation (*e. g.*, the older resistance boxes of Messrs. Siemens & Halske) has been abandoned by the Reichsanstalt in order to allow the coils to be placed in petroleum (in which paraffin is soluble), thus permitting a more accurate determination of their temperature and avoiding thermoelectric effects. For not only standard resistors, which are also designed for measurements of current strengths and which may be heavily loaded under these circumstances, but even resistance box coils and potentiometers are sometimes used to advantage in petroleum. If the use of petroleum is given up, an essential advantage which has been striven for in construction of the Reichsanstalt coils is lost."—Lond. *Elec.*, Aug. 8.

Electric Standards.—A report presented at the British Association for the Advancement of Science by the committee on electrical standards. The main work during the year has been the completion of the work with the ampere-balance. It appears that the result is probably accurate to 1 in 50,000. Expressed in terms of the international ohm, as realized at the (British) National Physical Laboratory, and of the ampere as given by the new current weigher, it is found that the value of $C \times R$ for the normal Weston cadmium cell is 1.01830_5 at 17 degs. C. This assumes that the value of g at Teddington is 981.19, a number probably correct to within 3 parts in 100,000. An uncertainty in this amount in g introduces a possible error of 1½ parts in 100,000 in the value of the ampere, and, as all other probable errors are smaller in magnitude, it is important that a more accurate determination of g be made. At present, the uncertainty in the absolute value of the international ohm approximates to 4 in 10,000. An account is also given of the present condition of the work on electric units at the (British) National Physical Laboratory.—Lond. *Elec. Eng'ing*, Aug. 8.

Spherical Photometer.—R. Ulbricht.—An article giving some supplementary notes on the use of his spherical photometer for determining the mean spherical candle-power or the hemispherical candle-power by a single measurement. The author first discusses how it is possible to avoid the errors due to the presence of foreign bodies within the sphere. In Fig. 4 M is the opening in the sphere through which the measurement is made, L is the lamp to be tested, and L_1 is the calibrated

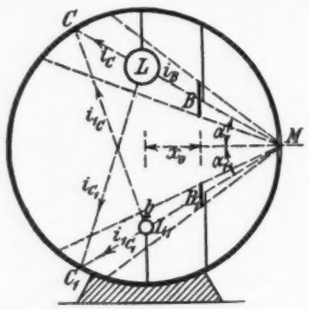


FIG. 4.—SPHERICAL PHOTOMETER.

standard lamp, while B and B_1 are the screens which prevent any direct light passing from the lamps to the observation window M. The constant of the sphere is determined by means of the standard lamp L_1, while the lamp L to be tested afterwards is already at its place, but, of course, not yet lighted. Afterwards during the test of L the standard lamp L_1 also remains at its place, but is, of course, not lighted. The size of the screen B should not be more than one-twentieth of the cross-sectional area of the sphere. ($R^2\pi$, where R the radius.) If the lamp L is tested without globe, the screen B when viewed from the observation window M must cover the source of light and the reflector. When the lamp is tested with a frosted globe, the screen must cover the whole globe. When the lamp is tested with a plain, clear glass globe, the screen must cover the source of light, the reflector and the mirror image of the source of light. The screens must in any case be large enough to prevent any direct light from reaching to the rims of the observation window. If F is the area of the screen B and F_1 the area of the screen B_1, then the error of measurement due to the presence of screens in the sphere is, in per cents, approximately $(80F - 100F_1) \div R^2\pi$ for spherical candle-power determinations and $(500F - 100F_1) \div R^2\pi$ for hemispherical candle-power determinations. If these formulas give values which cannot be neglected, the correction may be easily made by adding the above percentages. Finally, rules are given concerning the points where the lamps L and L_1 are to be placed. —*Elek. Zeit.*, Aug. 8.

Effect of Frequency on the Capacity of Condensers.—Coffin.

—It is proposed to construct an absolute air condenser of two circular plates of optically plane glass. Such plates cannot be easily made much larger than 10 cm in diameter, and hence they must be placed very near to each other in order to obtain a sufficiently large capacity. In order to render the two opposing faces of the plates conducting, they are half silvered so that light may be seen by transmission through them. They then form practically a Perot and Fabry interferometer and the beautifully sharp fringes seen by transmitted light enable their parallelism and distance apart to be observed with the utmost accuracy at any instance. Knowing the geometrical dimensions of the systems, its absolute electrostatic capacity can be calculated. The half-silvered conducting surface of the condensers, however, have a very high resistance and a doubt arises as to whether this condenser is completely charged and discharged when a rapidly varying e. m. f. is impressed upon it. The calculations made by the author to investigate this, show that when the surface resistance is high, the capacity falls off to an enormous extent for comparatively low frequencies. The capacity of a condenser diminishes with increasing frequency as well as the self-inductance of a coil; so that their effects are additive and in all work in which high-frequency currents are employed the experimenter must assure himself that certain corrections are negligible or must apply them.—*Physical Review,* August.

Three-Phase Induction Meter.—An illustrated announcement of the Reichsanstalt concerning the admission for calibration of an induction meter of the Siemens-Schuckert Company. The meter consists essentially of two induction motors, the armatures of which are coupled by an axle, and a magnetic brake for each armature and a common counting device. The construction and the operation of the motor are described in detail.—*Elek. Zeit.,* July 18.

Meter.—E. WAGMÜLLER.—The author recommends the charging of a certain flat rate for all energy consumed up to a certain value; the energy consumed above this value to be measured and paid for extra. A meter which enables the measurement of the excess energy is described.—*Elek. Zeit.,* Aug. 8.

Calorimeter.—W. P. WHITE.—An abstract of an American Physical Society paper on an accurate calorimeter which is used in connection with an electric resistance furnace.—*Physical Review,* August.

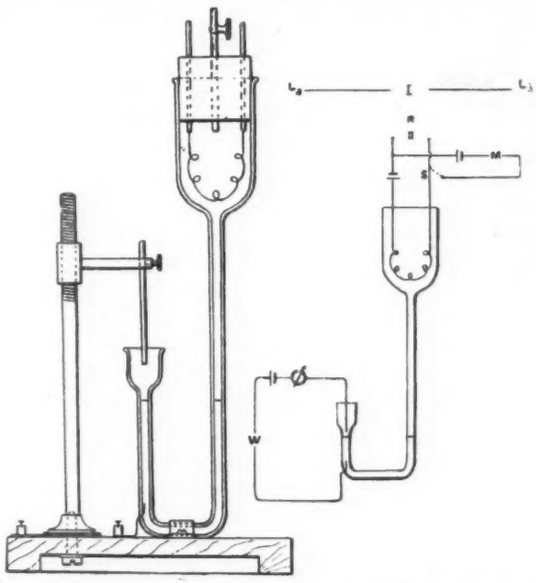
Ballistic Galvanometer.—F. WENNER.—An abstract of an American Physical Society paper in which the effect of the time of passage of a quantity of electricity on the throw of a ballistic galvanometer is studied.—*Physical Review,* August.

Telegraphy, Telephony and Signals.

Loaded Telephone Line.—W. PREECE.—A paper read before the British Association for the Advancement of Science, giving an historical account of the efforts which have been made to improve telephone transmission by increasing the inductance of the line. He more particularly discusses the Pupin method of using a line with induction coils in series and gives theoretical reasons for its success, together with an account of the work done by the New York Telephone Company under the direction of J. J. Carty. Tapering—or the gradual reduction of the inductance of the loading coils as the terminal stations are approached—is beneficial according to Hayes. The size of coils and the distance apart are said to be chiefly a question of experiment. The author seems to be in doubt whether coils with or without iron cores give better results.—Lond. *Elec.,* Aug. 9.

Loaded Telephone Lines.—B. S. COHEN.—Some remarks on the paper of Preece (see preceding abstract). As far as the writer's experience goes there appears no possible doubt as to the superiority of the iron-core coil over coils without iron, from both the technical and financial points of view. The wave length in telephone lines varies from a maximum of about 225 miles for a very heavy aerial line down to a minimum of about nine miles for a highly loaded cable. The spacing of the coils which has been adopted by the National Telephone Company in Great Britain is in general the same as that used in America and varies with the type of line to be loaded. No one spacing is found to meet all conditions. In practice about three standard spacings are employed.—Lond. *Elec.,* Aug. 9.

Hot-Wire Relay for Selective Signalling.—R. HEILBRUN.—Telegraphic circuits containing a number of stations of small traffic are frequently used in continental Europe, and it is of practical value, *e. g.,* for railway telegraphy, to devise means for selective signalling, or, at least, for enabling the stations to correspond with each other without disturbing one of them, the principal office, and for calling this principal office selectively. This is effected by means of a retardation relay placed at the principal office. The relay is traversed by the telegraphic currents common to all the stations in the circuit, but it works too slowly to be actuated by them. The essential part of an instrument of this type, developed by the author, is simply a hot wire and the principle is shown in Fig. 5. A relay of any usual type has its coil included in the telegraphic circuit, and when actuated causes currents to be sent through the hot wire. The wire can be seen with its loops inside the glass vessel of the illustration. But the ordinary signalling currents are of too short a duration appreciably to expand the air contained in the glass vessel, and in consequence the liquid rises only very little in the left limb. The quantity of the air is too large to be appreciably heated by the short currents, and the apparatus cools off too quickly to render possible the adding up of the numerous small effects to a large one. The air in the bulb



FIGS. 5 AND 6.—DIAGRAM OF HOT-WIRE RELAY.

expands sufficiently to make the relay respond only in case the Morse key is uninterruptedly depressed for several seconds. The responding is effected by the liquid making a contact when rising in the left limb. The selective quality of this hot wire arrangement was demonstrated by experiments in which a Morse key was impressed and currents varying between 43.5 and 7.1 milli-amperes were sent through the hot wire. The displacement of the liquid was observed first when the Morse sign of the letter V (. . . —) was slowly repeated three times and, secondly, when the current traversed the wire uninterruptedly for three seconds. The height to which the liquid rose in the left limb was in general one-third as large in the first case as in the second case. Fig. 6 shows the diagram of connections at the principal office, key and battery being left out. L_a and L_b is the line, *R* the ordinary relay, *I* denoting its primary contacts, *II* the secondary ones. The latter lead to the hot-wire relay. As a rule, the signalling in the circuit will not affect the hot-wire relay at the principal station. But when any of the stations depresses its key uninterruptedly for a few seconds, the hot-wire relay responds and causes the bell, *w*, to ring. By means of the switch, *s*, the relay is then switched off, and the Morse instrument, *M*, cut into the circuit. At the end of the communication with the principal station, the switch is again placed in its former position.—Lond. *Elec. Rev.,* Aug. 9.

Wireless Telegraphy.—A number of papers read before the British Association for the Advancement of Science. W. Duddell discussed the use of the arc method and of the spark method for generating electric waves. The arc methods seem eminently suitable for very high speeds of working, and render wireless telephony possible. Sir Oliver Lodge read a paper on modern developments and experiences in tuning as practiced in the Lodge-Muirhead wireless telegraphy system. J. T. Morris gave an account of an oscillographic study of low-frequency oscillating arcs. The chief object was to study the effect of a change in the medium in which the arc is burning and also to examine the effect, if any, produced on the arc by the application of a transverse magnetic field. The arc was studied in air, coal gas and in amyl acetate.—Lond. *Elec. Eng'ing,* Aug. 8.

Miscellaneous.

British Association for Advancement of Science.—An account of the 77th meeting of the British Association for the Advancement of Science, which was recently held in Leicester. The presidential address by Sir David Gill dealt mainly with problems of astronomy. The engineering section held meetings under the presidency of S. P. Thompson, whose address dealt with the question of pure and applied science. He maintained, first of all, that the pursuit of scientific research for its own sake or as an adjunct to industrial advancement depends entirely on the persons concerned. Some people cannot carry out an investigation unless they have the application of the investigation as a goal, while with other people the commercial application of a discovery is a matter of small importance, and they cannot take it into account during the progress of their work. He also instanced cases of industrial applications which actually compelled further scientific research.—Lond. *Elec., Elec. Rev., Elec. Eng.,* Aug. 2 and 9, and Lond. *Elec. Eng'ing,* Aug. 8.

Electroculture.—B. H. Thwaite.—A paper read before the (British) Royal Botanic Society describing the new experimental installation for the Royal Botanic Gardens in London. The author divides the early workers on this subject into those who utilized the effects of the arc light on the leaves of plants, and those who applied electrostatic stimuli to the plant and to the roots and stalks, in association with solar light. The author thinks that if we want to imitate all the natural forces which are effective on plant growth we have to supply, first, ample violet or chemically active rays from powerful arc lamps; second, the supply of electrostatic current from atmospheric root electrification; third, an atmosphere containing moisture and CO_2 in the proportions common to the most fertile countries at a temperature between 70 and 80 degs. Fahr.; fourth, an ideal fertilizing agent, and, fifth, an ample supply of water for the roots. In the installation described the necessary heat and actinic light, as well as the carbon dioxide moisture and nitrogen fertilizer, in the form of ammonia sulphate, are to be derived from coal with the aid of a suction gas producer and gas engine, whereby perfect combustion is obtained with the development of electrical energy. The arc lamps are equipped with special reflector hoods confining the beam of light within narrow limits of concentration.—Lond. *Elec. Rev.,* Aug. 2.

Laboratory.—E. C. Coker.—A paper read before the British Association for the Advancement of Science describing the new engineering laboratory at the City and Guilds of London Institute, Finsbury.—Lond. *Elec. Eng'ing,* Aug. 8.

BOOK REVIEW.

Electrons, or the Nature and Properties of Negative Electricity. By Sir Oliver Lodge. London: George Bell & Sons. 230 pages, 25 illustrations. Price 6s.

The nature of matter has been a fascinating subject for the philosopher and physicist, the thinker and the worker from the days of Democritus and Lucretius down to the present hour. And, indeed, it may safely be said that at no time in the history of scientific discovery was greater activity displayed in the study of problems relating to the constitution of the ultimate forms of matter than in recent years. Were proof needed, it would be afforded by every one of the 230 pages of this present well-printed and well-illustrated octavo.

This volume by Prof. Lodge, like his *Modern Views of Electricity* and numerous contributions to the *Philosophical Magazine,* shows a clearness of exposition which leaves no lingering doubt in the mind of the reader. The style is always simple and lucid, occasionally incisive, rarely sarcastic.

The author has done pioneering work in the electronic field and has discussed proposed solutions of outstanding difficulties with the leaders of scientific thought at home and abroad, so that this latest work of his is sure to command at once the confidence of the reader, even when dealing with the more speculative parts of the subject.

That the "electron" has opened up not only a new chapter, but also a vast domain in general physics will be evident from a glance at some of the titles of the successive chapters: Nature of chemical and molecular forces; increase of inertia due to rapid motion; the electron theory of conduction and radiation, etc.

Though several good works on that smallest of entities, the electron, have recently appeared, no student of physical theory can afford to be without this last volume from the pen of Prof. Lodge. It is a *résumé* written by the hand of a master of contemporary speculation.

Electric Dynamometers for Testing Gasoline Engines.

One of the easiest, most accurate and efficient means of obtaining instantaneous values of the brake horse-power of an engine is the electric dynamometer, and owing to the simplicity of the apparatus and calculations a test can be made by comparatively inexperienced attendants. In fact most of the automobile manufacturers employ this method in testing their gasoline engines. The Sprague Electric Company of New York City has brought out a line of electric dynamometers which has been essentially designed for absorbing and measuring the power developed by gasoline engines in factory tests. This dynamometer differs from the well-known Prony brake in

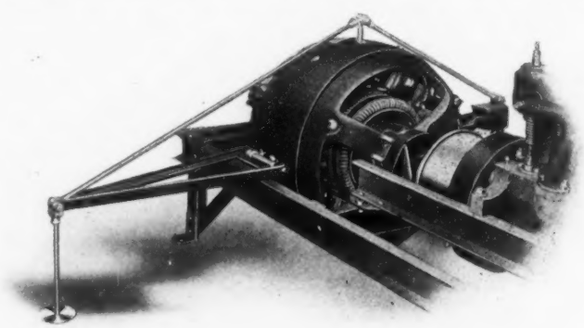


FIG. I.—ELECTRIC DYNAMOMETER.

that the reaction of friction is replaced by an electro-magnetic reaction, an advantage of great importance as is shown later.

The general arrangement of the electric dynamometer, shown in the accompanying illustrations, consists of a specially constructed direct-current generator with compensating poles. The generator field frame consists of a cylindrical magnet yoke to the inner side of which the poles are bolted, each pole supporting a field coil. Brackets which contain the bearings are bolted to the end of the yoke, the front bracket carrying the rocker arm. Special bosses are cast on the end brackets for receiving ball bearings which support the entire generator in such a manner as to permit the field frame to oscillate concentricly with the armature.

The movement of the field frame is limited by means of a

stud on the outside of the yoke. Two arms extend horizontally from opposite sides of the field frame. The short arm carries a metal box to receive the necessary amount of lead to counterbalance the field frame on its ball bearings. The long arm is provided with a hanger, on which slotted weights may be placed. The engine to be tested is set in position and bolted to the supporting frame in alignment with the dynamometer. The two shafts are then connected together with a flexible coupling and the engine started. The torque exerted by the armature is transmitted to the field and tends to rotate the field frame in the same direction as that in which the armature is turning. By placing weights on the hanger attached to the long arm previously mentioned, the torque is readily measured.

The horse-power HP developed by the engine may then be found by using the following formula. In this formula $W =$ the weight in pounds on the hanger, $D =$ the distance in feet from the center of the armature to the weight, and $S =$ the speed of the engine in revolutions per minute.

$$HP = W \times 2D \times 3.1416 \times S \div 33{,}000.$$

It will be noted in this formula that the only variables with a given dynamometer are the weight W and the speed S. If a curve be drawn or a tabulation made showing the horse-power developed at different speeds, an ordinary mechanic can perform the tests without making any calculations. The voltage and current produced by the dynamometer do not enter into the calculations. In some cases it is possible to utilize the electricity generated by the dynamometer by connecting direct

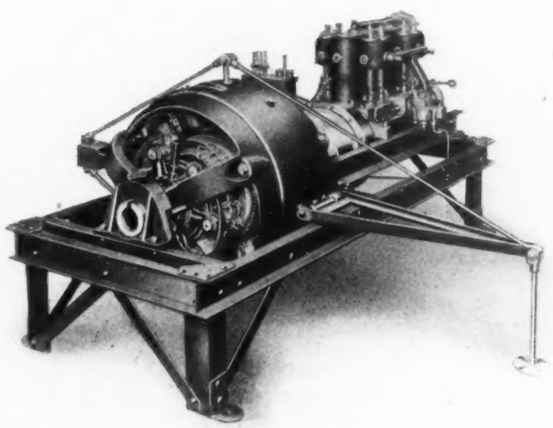


FIG. 2.—ELECTRIC DYNAMOMETER.

to the shop wires and operating the dynamometer in parallel with the generators already in service. Under these conditions variations in the engine speed can be obtained very easily by adjustment of the rheostat in the field circuit of the dynamometer. If it is not convenient to utilize in this way the electricity generated by the dynamometer, it can readily be absorbed in a water rheostat.

It is also possible to use the dynamometer as a motor to start the engine, taking energy from the shop mains or an outside supply circuit, thus saving the labor of "cranking."

This use of the dynamometer also affords an accurate means of determining the torque necessary for starting the engine and for testing the engine frictional losses under various conditions. The dynamometers are manufactured in sizes from 10 to 100 horse-power, and any one of these sizes is capable of operation over a wide range of speeds and loads. A structural steel frame for supporting the dynamometer and gasoline engines of various sizes is also provided.

Exhibits at Ohio and Michigan Conventions.

The conventions of the Ohio Electric Light Association and the Michigan Electric Assoication, at Toledo, Ohio, and at Battle Creek, Mich., last week, brought out a number of exhibits, some of which contained new and interesting features for central-station men.

THE ONEIDA GALVANIZED CHAIN for arc lamp suspension was exhibited at Toledo.

THE HOLOPHANE COMPANY had a demonstration and exhibit of reflectors and globes at Michigan.

TURBINE CONSTRUCTION.—The Allis-Chalmers Company had on exhibition the turbine blades of its steam turbine, together with some of its electrical machinery, in the shape of motors.

Mr. J. B. Coale, of the Columbia Lamp Company, also had secured for exhibition some of the new German incandescent lamps made from rare metals.

THE FORT WAYNE ELECTRIC WORKS exhibited meters, arc lamps, small motors, etc. The W. G. Nagel Electric Company, of Toledo, made a parlor exhibit of some of the supplies it handles.

THE FOSTORIA INCANDESCENT LAMP COMPANY had in the hotel lobby at Battle Creek the new Gem meridian type of lamp and the 80-watt tantalum in addition to the tipless and common standard types.

THE NERNST LAMP COMPANY lighted the hotel convention hall at Toledo with its new direct-current glowers. The new glowers are 37 per cent more efficient than the old, and are made for both direct and alternating currents.

MISCELLANEOUS ELECTRICAL SUPPLIES.—The Western Electric Company made an exhibit at both conventions, in which prominent features were high-tension line material, arc lamps and regulators. Direct-current and three-phase induction motors were also shown.

ELECTRIC HEATING APPLIANCES.—The W. J. Barr Electric Manufacturing Company, of Cleveland, made a large and admirable exhibit, introducing some of its excellent new electric heating appliances, which it has recently perfected; in addition to its flatirons, whch are already well known. This included two-quart water boilers, curling irons, chafing dishes, percolators, etc.

LIGHTNING ARRESTERS.—The Gifford non-arcing lightning arrester was exhibited for the first time at the Michigan convention. This is made by Campbell Brothers, of Traverse City, Mich. It consists of a number of carbon high-resistance rods in multiple, each rod being connected in series with a small spark gap. Static discharges pass through these high-resistance rods and spark gaps in multiple to the ground, the resistance being too high for the line current to follow.

LAMPS.—The General Electric Company exhibited a number of 100-volt, 105-watt tungsten lamps. Apparently, the breakage on their exhibit shipments was not as large as at previous exhibitions, encouraging the belief that the question of such loss in shipment will ultimately be solved. The tungsten 25-watt, 28-volt lamp for operating in clusters, four in series, was exhibited, and at the Michigan convention, experiences were given as to its use at Sault Ste. Marie. This lamp has a left-handed thread, so that it cannot be destroyed by being accidentally put into common multiple sockets. The round-bulb meridian tantalum lamp was also one of the new-comers shown.

SINGLE-PHASE MOTORS.—The most prominent exhibit at Toledo was that of single-phase motors made by the Wagner Electric & Manufacturing Company, and located in the hotel lobby. Messrs. Thomas T. Richardson, Nat Emerson and Harrison Wright were in charge. The new feature was a Wagner variable-speed ventilating fan motor of 2 horse-power, with a 30-in. fan. This is of the variable-speed type with auto-transformer control and can be operated continuously at any one of several speeds. The same motor is adapted to variable speeds running with printing presses and other work where variable torque is not required. Besides this single-phase motor, one of the company's polyphase motors and its lamp-testing wattmeter were shown.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—It would appear from reports made all over the country that the outlook for fall trade is excellent. Buyers in many lines are replenishing stocks and preparations in general indicate confidence as to large and sustained consumption in all staple goods; while the heavy import trade would incline one to suspect that luxuries are not being forgotten. Yet there is no evidence of a tendency to over-trading, the attitude of merchants being, if anything, reserved and cautious. Weak points in the structure of industrial credit have apparently been easy to locate and remedy, because of their scarcity. *Dun's Review* says: "Jobbing markets are well attended by interior buyers and country merchants, who operate with great freedom, considering the financial stringency which has compelled the postponement of much contemplated structural work. Yet many Western and Southern cities report building operations far in excess of last year's, and as the harvests progress there is more disposition to increase preparations for future needs. Retail stocks have been depleted by the customary bargain sales, and preparations for fall and winter trade indicate confidence in continued activity. At most domestic points there is no complaint regarding collections, but reports from Canada indicate many requests for renewals. Leading industrial plants are well occupied, many mills having output sold far into 1908, and there is little serious interruption by strikes. A sharp rise in grain was the feature of the commodity markets, but best prices were not maintained." As to copper, the tendency seems still to be downward; at least, prices look that way, Lake reaching 18.50 cents bid and electrolytic 17.50. There is said to be a small, but steady accumulation of supply going on even at these figures, which, after the high range of a few months ago would seem calculated to bring into the market heavy consumers known to have been holding off. The crop reports, while not particularly optimistic, would indicate that on the whole the agriculturist will have another good year and average up as well as he did in 1906.

THE COPPER MARKET.—With regard to conditions, the National Conduit & Cable Company says in its "Copper Gossip": "All developments in the copper market recently have certainly been in the consumer's favor and no important sales are being made. The irregularity in quotations is a most unfortunate thing for producer and consumer alike, and market stability is impossible so long as sellers continue this irregularity in an absolutely dull situation. Such a proceeding can only work confusion in the trade and is exceedingly detrimental to manufacturers conducting a legitimate business. There is an unfortunate condition which would seem to be created more or less by speculators and those who are known as manipulators, which lend credence to the theory that quotations are often made with a view to their influence on Wall Street and the hope of securing financial gains by conspiring to create an unhealthy condition either by over-inflation or undue depreciation of values, as the case may be, but the general result upon business interests is very bad. When the demand was unusually good, copper was rushed up to 26½ cents per pound, when the wiser policy would have been never to have allowed it to go above 20 cents. The precipitate haste in advancing prices met with some efforts to counteract this action, but more short-sighted interests were unable to resist the temptation to exact the big premiums obtainable from the needy consumer, and even at top prices it was hard to obtain a full supply except for distant future. After the tension of last year has become a thing of the past the trade conditions are coming down to a normal and more healthy basis. The whole situation is perplexed by the action of an erratic copper market, and consumers for their own safety are compelled to adopt a waiting policy. What the manufacturer and buyer needs is the assurance that they can safely buy copper for two or three months' deliveries and not be left in the lurch before 30 days have passed by a radical decline in the market value of their raw material. Conditions in manufacturing lines are fairly active, and such as to warrant the maintenance of a reasonably firm copper market, provided the unnatural means for depressing it cease. The present rate of consumption is less than that of last year, but the pace 10 or 12 months ago was very much too fast to continue, and the country was attempting more than it could reasonably finance. Now current business is sufficiently good to keep up a steady demand upon the mills of the country at a fairly encouraging level, and with the proper readjustment of the copper market to existing conditions trade should open up hopefully in the fall. The larger American producers have been quite inactive of late, but they have not made any formal announcement of a change in price of electrolytic since the 22-cent level was established. Quotations by irresponsible parties are very misleading, and to the consumer really mean nothing, as not a pound of copper is bought or sold at the alleged low prices. The proceeding is kept up by regularly quoting copper, presumably for the sentimental effect it has in all business circles in this country and Europe. Conservatism should be the watchword of the consumer, and a "hand to mouth" policy followed until our unfortunate financial problems are solved, and the market for raw copper is on a stable and solid basis."

ELECTRICAL MANUFACTURING.—An interesting special dispatch from Boston says: "The business of four large electrical companies for the first half of the year contains no justification for the somewhat disturbing reports of a dropping off in business and a wholesale reduction of working forces. The General Electric Company booked over $35,000,000 of orders in the first half of the present fiscal year, compared with about $29,000,000 in the same period of 1906. Western Electric gross for the first six months of the current fiscal year was about $30,000,000, or $1,000,000 less than for the same half of last year. Westinghouse officials estimate shipments for the current year, based on the results of the first five months, at over $42,000,000. The Allis-Chalmers closed its year June 30, and gross receipts are understood to have been approximately $20,000,000. It is, of course, probable that in the event of any general let-up in business, new orders for electrical apparatus will drop off in the last six or seven months of the current fiscal year. At the same time the General Electric, Westinghouse and Allis-Chalmers each has orders booked ahead sufficient to keep the shops in full operation for five or six months. Based on actual results for the first five or six months of the present fiscal year, and assuming that in the current year Allis-Chalmers does no greater business than during the 12 months just ended, the gross earnings of the four companies would work out at the following rate:

	Present Fiscal Year.	Previous Fiscal Year.
General Electric	$70,000,000	$60,071,883
Westinghouse	42,000,000	33,026,240
Western Electric	60,000,000	69,245,331
Allis-Chalmers	20,000,000	20,000,000
Total	$192,000,000	$182,343,454

The gross receipts of the four companies show an increase of nearly $10,000,000, or over 5 per cent over the previous year."

THE CHICAGO SUBWAY.—According to advices from Chicago, President McRoberts, of the Illinois Tunnel Company, says that connections with 23 railroads having freight terminals will be completed Nov. 1. It is officially estimated that by Jan. 1 the daily movements in the tunnel will be 10,000 loads, or between 20,000 and 30,000 tons of freight daily. The daily mail transferred aggregates 32,000 to 35,000 pouches. The subway consists of 51 miles of bore under the loop, duplicating 18 streets east and west, and 12 streets north and south, with 325 street intersections, at an average depth of 42 ft. except at the river approaches. There will be 3000 cars and 130 electric locomotives instead of 1200 and 80, respectively, at present. The average speed of a tunnel train is 8 to 10 miles an hour, including stops, with a possible maximum of 15 miles. General Manager Kenyon has arranged a duplicate loop system of operation whereby 30,000 cars a day, with 90,000 to 100,000 tons of freight, might be moved every 24 hours by three shifts of employees. Block signals and automatic

switches will be introduced. All tunnel track is laid with 56-lb. rails, with a gauge of 2 ft. At each street intersection there are four three-way switches.

EFFECT OF WIRE STRIKE.—It is stated from Baltimore, Md., that the telegraphers' strike is helping the Rowland Telegraphic Company of that city. The company has had its factory running overtime since the strike broke out, filling orders for machines. The Postal Telegraph Company for more than a year has had the machines in operation between Boston and New York, and this week placed them in service between Chicago and St. Louis, and between New York and Philadelphia. The company will use them also between New York and Chicago, and probably in a number of other cities.

Financial Intelligence.

THE WEEK IN WALL STREET was a notable one in the general wiping out of values that it witnessed. As a matter of fact, the past month has seen a depreciation in active securities of over $900,000,000, and the total depreciation is put at about $3,000,000,000. Bonds have also declined heavily. If anybody thinks this loss has fallen merely on "malefactors of great wealth," or that the malefactors conspired to do this on themselves, the day of belief in miracles is not past. It is generally understood, however, as incidental to this situation that Standard Oil interests have withdrawn support in various ways from the market, and have given orders of curtailment in whatever industries their capital may be engaged in. There are, however, enough unsettling causes without looking for an explanation of all the troubles to a conspiracy which if it could be proved would blast and exile in ruin every man even remotely engaged in it. Meantime things would seem to have brightened a bit, and would possibly be much better but for the disastrous situation in the Interborough-Metropolitan traction

NEW YORK.

	Aug. 20	Aug. 27		Aug. 20	Aug. 27
Allis-Chalmers Co.	6½	5½	General Electric 124½		124
Allis-Chalmers Co. pfd.	20	17	Hudson River Tel.....	—	—
Am. Dist. Tel.....	—	—	Interborough Met. com.	8½	8½
American Locomotive..	52	50½	Interborough Met. pfd..	23	22¼
Amer. Locomotive pfd.	101	99	Mackay Cos.	60½	62¼
American Tel. & Cable.	75	70	Mackay Cos. pfd.....	60	60¾
American Tel. & Tel..	105	104	Marconi Tel.	—	—
Brooklyn Rapid Transit.	43	41½	Metropolitan St. Ry...	42	42*
Electric Boat	33	33	N. Y. & N. J. Tel.....	—	—
Electric Boat pfd.....	80	80	Western Union Tel...	—	75
Electric Vehicle	—	—	Westinghouse com 130		134
Electric Vehicle pfd...	—	—	Westinghouse pfd	—	—

BOSTON.

	Aug. 20	Aug. 27		Aug. 20	Aug. 27
American Tel. & Tel..	—	106¼	Mass. Elec. Ry. pfd...	52	50
Cumberland Telephone.	—	—	Mexican Telephone ...	2	2
Edison Elec. Illum....208		206½	New England Telep....108		108
General Electric 124½		—	Western Tel. & Tel...	—	5½
Mass. Elec. Ry.....	—	13	West. Tel. & Tel. pfd..	—	67*

PHILADELPHIA.

	Aug. 20	Aug. 27		Aug. 20	Aug. 27
American Railways	—	47	Phila. Electric	7⅞	7¾
Elec. Co. of America...	—	8⅜	Phila. Rapid Transit...	16⅛	15¼
Elec. Storage Battery..	46	44	Phila. Traction	—	90
Elec. Stor. Battery pfd.	—	—			

CHICAGO.

	Aug. 20	Aug. 27		Aug. 20	Aug. 27
Chicago City Ry.....	—	150	National Carbon	—	70
Chicago Edison	—	136	National Carbon pfd...	—	110
Chicago Subway	—	183¾	Union Traction	—	—
Chicago Tel. Co.....	—	106	Union Traction pfd....	—	—
Metropolitan Elec. com.	—	—			

*Asked.

securities of New York, where the merger has been attended with most adverse developments and where dividends on the tremendous overcapitalization are at the vanishing point. But there are brighter aspects. Secretary Cortelyou has taken steps to ease the money market by placing deposits during the next five weeks of deposit at banks in different localities. The reports of 30,000 correspondents of the Commercial National Bank of Chicago are conservatively favorable without an exception, and exhibit no misgiving as to the future. The steel outlook is excellent, and railway earnings in the first half of August were 7.5 per cent larger than last year's figures. Official returns of foreign commerce in July far surpassed the same month in any previous year, the gain over 1906 amounting to $22,000,000 in imports and $17,000,000 in exports. The best sign was an increase in small purchases by investors. Time money grew firmer, which did not encourage speculative purchases. Bank exchanges at New York were 32.1 per cent less than in the same week last year, when speculation was active, but at other leading cities there was an average gain of 7.6 per cent. With regard to failures, *Bradstreet's* reports 153 failures in the United States during the week, against 142 for the previous week, and 155, 176, 185 and 142 for the corresponding weeks of 1906 to 1903. Canada had 19, against 30 for the preceding week. About 83 per cent of the total number of concerns failing had capital of $5,000 or less, and 11 per cent had from $5,000 to $20,000 capital. The quotations of stocks for Aug. 27 are given herewith.

NEWBURGH LIGHTING STOCK.—The New York Public Service Commission in the Second District has announced that it has denied the application of the Newburgh Light, Heat & Power Company for leave to increase its capital stock from $500,000 to $750,000. The application, the commission says, was really for permission to issue $250,000 8 per cent cumulative preferred stock. The decision, prepared by Commissioner Decker, says that if the proposed increase was approved it "would create a permanent annual charge of $20,000 upon the property, and in our judgment allowance of a permanent fixed charge of this character to meet temporary exigencies of the money market is not justified. Favorable action upon this petition would constitute a precedent which, if followed in other cases, might operate disastrously to minority stockholders, and also work hardships upon affected communities through the continuous necessity for service rates or charges sufficiently high to meet such permanent obligations."

CHICAGO TELEPHONE.—Advices of Aug. 22 from Chicago says: "All but $200,000 of the $4,000,000 of new capital stock of the Chicago Telephone has been subscribed for. The balance will be disposed of if it does not go to the stockholders who are entitled to it, but who are out of the United States and probably did not receive their notice. It appears that the trading in the subscription rights on the local Stock Exchange created a bad tangle in the work of allotting the new stock. The privileges were greatly overtraded in, and it has been with difficulty that the company was able to determine who among the outside buyers were entitled to the new shares at par."

BALTIMORE ELECTRIC EARNINGS.—The earnings of the Baltimore Electric Company for six months, Jan. 1 to June 30, are as follows:

	1907.	1906.	Changes.
Gross	$372,177	$315,869	Inc. $56,308
Op. exp. and taxes.	208,129	191,869	Inc. 16,260
Net	$164,048	$124,000	Inc. $40,048
Interest on bonds.	113,000	112,596	Inc. 404
Surplus	$51,048	$11,404	Inc. $39,644

WESTINGHOUSE ELECTRIC.—The Westinghouse Electric & Manufacturing Company reports for July and four months ended July 31, 1907, as follows:

	July.	4 Months.
Manufacturing profits.....	$428,422	$2,134,247
Miscellaneous income.....	106,064	343,335
Total income.....	534,486	2,477,582
Interest, depreciation, etc.....	229,660	1,099,874
Net surplus.....	$304,826	$1,377,708

ALLIS-CHALMERS BONDS.—Allis-Chalmers Company will soon issue a call for the tenth and last payment of 10 per cent on the bond issue of $13,000,000 created last year. Of that amount approximately $10,500,000 was subscribed for, the syndicate taking about $9,500,000. This will give the company about $1,000,000 additional cash. It is interesting to note that not a single member of the bond syndicate has failed to make his regular payments when called upon to do so.

THE STANLEY WORKS COMPANY, of New Britain, Conn., has received authority to double its capitalization of $1,500,000. This company has also received legislative permission to transmit electricity for power from its plant, on the banks of the Housatonic River, near Kent, by high-tension cables to its plant in New Britain.

DIVIDENDS.—Directors of the Twin City Rapid Transit Company have declared the regular quarterly dividend of 1¾ per cent on the preferred stock, payable Oct. 1. Union Gas & Electric Company has declared its regular quarterly dividend of 1½ per cent on preferred, payable Oct. 1.

CANADIAN GENERAL ELECTRIC.—The stockholders of the Canadian General Electric Company have ratified the proposal to increase the stock from $5,000,000 to $8,000,000, $2,000,000 of the new stock to be 7 per cent cumulative preferred.

CALIFORNIA GAS & ELECTRIC.—The directors of the California Gas & Electric Corporation at a recent meeting in San Francisco decided to increase the capital stock of the company from $15,000,000 to $35,000,000 at a meeting of the stockholders to be held in October. President John A. Britton states that after this increase the corporation will be in a position to redeem the outstanding bonds of its various subsidiary companies throughout the state as they fall due. Mr. Britton says: "It will also enable us to sell new bonds in a blanket issue to provide for improvements made by subordinate concerns. It is a simple and convenient plan of corporation finance. The value of the properties held by the California concern is about $55,000,000, on which the capitalization has been comparatively small—only $15,000,000. The directors have decided to increase the capitalization by an additional $20,000,000, to comply with the law relative to the necessary proportion between capital stock and bonds issued. We will then be able to sell new bonds and make one issue take care of the indebtedness and improvements needed by the subsidiary companies. The bonded debts of these concerns will be refunded by means of the single blanket issue, which will be a more satisfactory plan of finance." The California Gas & Electric Corporation, together with the San Francisco Gas & Electric Company, constitutes the Pacific Gas & Electric Company. These comprise some 15 smaller gas and electric companies doing business in quite a number of counties and interior towns as well as in San Francisco. It controls among other properties the Bay Counties Power and Standard Electric companies. This financial scheme is supplemental to the action of the Pacific Gas & Electric Company recently in deciding to raise $3,000,000 by assessing its stockholders $10 a share on their aggregate holdings of 300,000 shares of stock.

WESTERN ELECTRIC OUTPUT.—Advices from Boston state that the gross business of the Western Electric Company for the present fiscal year will be affected to some extent by the undoubted overstocking in telephone apparatus in which the majority of the Bell associate companies indulged last year. Reliable estimates show that at the opening of 1907 the subsidiary companies had on hand over $10,000,000 of telephone supplies, which were being carried in stock. For the six months ended June 30 last the gross receipts of the Western Electric were but $1,000,000 less than for the same period a year ago. In 1906 the Western Electric booked total orders for over $69,000,000 of apparatus. Business was a little larger in the last six months than in the first half of the year, but it is safe to place the aggregate gross business for the first six months of 1906 at fully $30,000,000. On this basis the Western Electric is now doing a business at the rate of $60,000,000 per year. About $25,000,000 of the total $69,000,000 gross receipts in 1906 were for other lines of electrical apparatus than telephone supplies. The volume of this "outside" business is constantly increasing, and forms one of the most profitable departments of the Western Electric's production. There has been no recent reduction in the number of men employed by the Western Electric Company. In March the company reduced its working force by from 2500 to 3000 men, but there have been no further reductions since that date. The company had the maximum number of employees on its books in August, 1906, during the heaviest rush of telephone orders, when a total of 30,000 were employed. By Dec. 31 this number had declined to 27,000, and is probably now about 24,000.

KANSAS CITY NOTE ISSUE.—The stockholders of the Kansas City Railway & Light Company at a special meeting have voted to issue $5,500,000 five-year 6 per cent notes and authorized the creation of a mortgage covering the same. Subscriptions for $4,125,000 of the issue have been asked of stockholders at 95, in the ratio of 22 per cent of the par value of shares in the company now held. The notes will bear interest from Sept. 1, 1907, and will mature Sept. 1, 1912. Of the issue $4,125,000 are to be known as series A, and $1,355,000 as series B. Each of the former $1,000 notes is to be converted at the option of the holder, on and after Sept. 1, 1908, into 6½ shares of the common capital stock and seven shares of the preferred capital stock of the company. The security authorized by the stockholders for the notes includes a pledge of at least $5,500,000 par value of notes of the Metropolitan Street Railway, of Kansas City, at least $1,900,000 par value notes of the Kansas City Electric Light Company, $2,695,000 par value of common capital, and $2,977,900 par value of preferred capital stock of the Kansas City Railway & Light Company. The stockholders authorized the directors to issue series B in amount of $1,375,000 at their discretion in the future, to sell them, and use the proceeds in the interest of the company.

NEW YORK TRACTIONS.—It is stated that the dividends on the preferred stock of the Interborough-Metropolitan Company, as well as the guaranteed dividend on the old Metropolitan Street Railway stock, which has met with such violent declines in the markets in the last few days, will be passed at the next meeting of the directors. In spite of the denials of several men who are in close touch with the affairs of the two companies, that there was any basis for the rumors of a reorganization of the traction situation in this city which would account for the violent declines in the stocks of the merger and its constituents, Wall Street is ready to believe that the last dividend has been paid as the stocks stand now. One of the voting trustees of the merger and a long time director of the Metropolitan system said: "There is absolutely no truth in the reports that a receivership is in prospect for the Interborough-Metropolitan Company. There is no ground for such a report whatever, nor is there any more reason for the other rumors concerning reorganization or readjustment of the company's affairs or finances."

KNOXVILLE RAILWAY & LIGHT.—The report of the Knoxville Railway & Light Company of Tennessee for the year ended June 30, 1907, and for the six months to June 30, for the years 1907 and 1906, follows:

	Year End. June 30, '07	Six Months Ended June 30 1907	1906	Increase.
Gross	$559,689	$282,929	$228,581	$54,348
Exp. and tax	298,360	154,523	142,725	11,798
Net earn.	261,329	128,406	85,856	42,550
Int. charges	119,034	62,192	49,126	13,066
Surplus	142,295	66,214	36,730	29,484
Set aside for res. and dep.	30,000	15,000	15,000	.....
Net surp.	$112,295	$51,214	$21,730	$29,484

The deduction for reserve and depreciation was not made monthly in the year 1906, but a single deduction of $30,000 was made in December, half of which is here considered as applying to the first half of the year 1906. The company has paid regular dividends of 6 per cent upon the preferred stock since issuance, and is now paying dividends at the rate of 4 per cent per annum upon its common stock.

PITTSBURG LIGHTING LOAN.—The Duquesne Heat & Light Company, of Pittsburg, of which Robert C. Hall is president, has arranged for a loan of $10,000,000 from the Fidelity Title & Trust Company. With the money the company proposes to build a rival heat and light plant to that operated by the Philadelphia Company, which has a monopoly on the business in Allegheny County. Recently the Philadelphia Company advanced the price of gas by 30 cents per 1000 cu. ft., and the state authorities have been asked to bring quo warranto proceedings against the concern to annul its charter. The Duquesne Company proposes to issue bonds for the amount of the loan and has issued an appeal to the public for support. The company proposes to erect an electrical plant to cost $1,500,000.

SPRINGFIELD UNITED EARNINGS.—The report of the United Electric Light Company of Springfield, Mass., for the year ended June 30, 1907, compares as follows:

	1907.	1906.	Increase.
Gross earnings	$447,667	$380,839	$66,828
Expenses	249,893	200,468	49,425
Net earnings	197,774	180,371	17,403
Dividends (8 per cent).	80,000	80,000	.....
Surplus	117,774	100,371	17,403

NEW YORK CITY BONDS are unsalable these days and are being handed out to pay bills and then sold at a discount. Mr. August Belmont has announced that the Interborough Rapid Transit Company would take bonds for what the city owes the company. There is due to the company on the Brooklyn subway extension and for terminals and extra work about $1,500,000.

U. S. TELEPHONE.—The United States Telephone Company reports June gross earnings of $35,491; six months gross, $234,038, a net for the six months of $135,284 and a net over all charges of $53,236, all items being an increase over the corresponding period.

AUBURN & SYRACUSE.—The Auburn & Syracuse Electric Company's June quarter report shows a gross of $89,454, a gain of about $5,400 over 1906. The surplus over all charges was $16,892.

GENERAL NEWS

Construction News.

ANNISTON, ALA.—The work of securing the right of way for electric lines from Jackson Shoales, near Tallegago, to Anniston is about to be started and material has already been ordered for building the line. It is understood that these steps are being taken by the Electric Share & Bond Company which owns the Jackson power rights in addition to owning the Anniston Electric & Gas Company and other electric light and power franchises. The company proposes to sell electrical energy in Anniston for less than it can be produced by manufacturers in that town.

DECATUR, ALA.—Manager H. B. Johnson, of the Decatur Light, Power & Fuel Company, states that his company expects to spend the sum of $70,000 on the improvements of its plant in New Decatur, which supplies both Decatur and New Decatur with electricity. The plant also furnishes power for the North Alabama Traction Company of the Decaturs. The company has already spent $5,000 on the improvement of the plant.

DOWNIEVILLE, CAL.—The promoters of the big power plant at Denton on the Feather River announce that before the project reaches its consummation a new railroad connecting Marysville and Oakland may result. A 10-ft. dam is to be constructed at the mouth of Gold Lake and the water piped down Gray Eagle Creek to the power plant. It is claimed that 20,000 hp can be generated in this manner.

ETNA MILLS, CAL.—It is stated that the proposition is being agitated to bond the town for the purpose of buying the water works, installing a sewer system and acquiring a source of electricity for light and power purposes.

PASADENA, CAL.—The Electric Light & Supplies Commission of the City Council is stated to have decided to enlarge the municipal electric lighting plant by adding 150 lamps, 50 to be arcs and 100 incandescents of 32 cp. C. C. Glass, manager.

REDONDO, CAL.—The War Department is reported to have granted to the Los Angeles Wave Power & Electric Company (Fred. Starr, president), of Los Angeles, all necessary rights and privileges for the establishment of a plant here.

SACRAMENTO, CAL.—The Great Western Power Company has secured rights of way from Antioch to Richmond by way of Concord for its high-tension wires. At Antioch the high-tension wires will cross the river on two high steel towers and continue on over right of way more than 100 feet wide.

SAN FRANCISCO, CAL.—At a recent meeting of the Artificial Lights Committee of the Board of Supervisors, John A. Britton, president of the San Francisco Gas & Electric Company, submitted a chart showing the locations of the lamps to be restored in the burned district. The company will install 1300 gas lamps and 63 arc lights and Chinatown will be lighted at once. He also submitted a statement showing that of the appropriation of $275,000 for public lighting, the sum of $215,641 would be required to pay for the lighting of 4210 gas lamps and 1616 arc lights in use on July 31, leaving a balance of $25,309 to be devoted to the rehabilitation of lamps in the burned district and the erection of new lamps in the suburbs.

CANON CITY, COL.—The Beaver Creek Power Development Company has filed in the county clerk's office a map and plan of the company's development. The purpose of the company is to develop electric power in connection with the Beaver Land & Water Company improvements. The pipe lines have their head gates on East and West Beaver Creek. The East Beaver line will be nearly ten miles long and will be constructed of 24-inch pipe having a capacity of 15 cu. ft. of water per second with a fall of 1800 ft. The West Creek line will be a little over 4½ miles long, will be constructed of 30-inch pipe and have a capacity of 18 cu. ft. of water per second with a fall of 1200 ft. The power station will be erected below the junction of the creeks and the approximate cost of the undertaking will be $750,000.

AVON, CONN.—Work on the new electric light line from Unionville to this town has begun.

MERIDEN, CONN.—Plans are under way for lighting the dome of the new town hall with electricity in a fashion similar to that of the dome of the State capitol at Hartford.

NEW BRITAIN, CONN.—The Connecticut Railway & Lighting Company has made a reduction in the price for electricity in this city and vicinity. The new schedule provides for a decrease of 10 per cent on all bills from $1 to $25 a month, 20 per cent on bills between $25 and $50, and 37 per cent on bills over that amount. The minimum monthly bills will be $1 and there will be no discount for cash payment within ten days.

NEW LONDON, CONN.—On account of an accident to the big turbine in the Water Street plant of the New London Gas & Electric Company electric service was interrupted for a time. Before night, however, the circuits were again in operation.

WATERBURY, CONN.—The Connecticut Railway & Lighting Company has reduced the rate for electric energy over its entire system as follows: There will be a 10 per cent decrease on all bills from $1 to $25 per month, a 20 per cent decrease on all bills between $25 and $50, and about 37 per cent decrease on all bills over $50. The minimum monthly bill will be one dollar and the usual discount for cash in 10 days is revoked.

WASHINGTON, D. C.—The Potomac Electric Power Company has petitioned for a hearing before the Board of Assessors in order that the question of the taxation of service conduits and meters may be thoroughly discussed.

WASHINGTON, D. C.—Bids will be received until Sept. 18 by the General Purchasing Officer Isthmian Canal Commission, Washington, D. C., for furnishing, as per circular No. 387, the following: Steam riveting machine, pneumatic tools and hoist, electric drills, repair parts for steam shovels, testing apparatus for power plant, vacuum pump, electric motor, steel, iron, rivets, cotters, boiler and condenser tubes, etc.

MACON, GA.—Next week the new electric and power company, chartered as the Americus Railway & Light Company, will take over, by purchase, the electric and gas plant here.

MILLEN, GA.—It is stated that bids will be received about Sept. 12 by H. Q. Bell, Mayor, for an electric light and water plant for this place. Probable cost, $30,000. J. B. McCrary & Company, engineers, Atlanta.

BOISE, IDAHO.—The Twin Falls, Northside Land & Water Company will award a contract early next month for the next section of canals and possibly three reservoirs covering 150,000 acres. The Shoshone Falls power plant, built by the Shoshone & Twin Falls Water Power Company, was completed two weeks ago. The wires are all in and Twin Falls was supplied with electricity last week.

ELGIN, ILL.—The Aurora, Elgin & Chicago Electric Company has completed the work of burying its wires and conduits in the business section of Elgin. About 100 poles have been taken down from the streets since the work was started, and within a short while the company expects to erect a new sub-station.

JOLIET, ILL.—The Lamont light plant has been purchased by the Economy Light & Power Company.

MANITO, ILL.—This city is to have electric lights in the near future. Carl Miller, who is a practical electrician, has moved here from Bloomington and will proceed to install the plant as soon as possible.

SHAWNEETOWN, ILL.—A. L. Swanson, of Evansville, Ind., has been awarded the contract for a complete electric light plant for this city.

URBANA, ILL.—The work of rebuilding the light, heat and power plant in this city is progressing.

BLOOMINGTON, IND.—Negotiations have been completed at Columbus, Ind., for the sale of the Columbus Street Railway & Light Company's property to the Central Indiana Light & Power Company.

CLAY CITY, IND.—J. H. Bence, town clerk, writes that the town would grant a franchise for an electric lighting plant to responsible parties.

MICHIGAN CITY, IND.—Work upon the Michigan City Gas & Electric Company's power house has been resumed.

MUNCIE, IND.—The Muncie Electric Light Company is preparing to install some large machinery in the new addition being made to its plant. When finished the plant will be one of the most modern and extensive of the kind in the State.

DAVENPORT, IOWA.—The new power station of the Independent Power & Light Company in this city will be constructed of concrete blocks in two pieces, the contract having been let to the Tri-City Cement Products Company.

BANGOR, ME.—The Ellsworth Power Supply Company has petitioned for the right to erect and maintain a pole line from Ellsworth to Bangor. Public notice was ordered in accordance with the statutes and a hearing under the petition will be given Sept. 5.

TURNER, ME.—The water wheel for the new electric light power house is being put in place, and the owners expect to have the dynamo in running order in a short while.

BALTIMORE, MD.—The Consolidated Gas, Electric Light & Power Company has been sued by the city for the expenses incurred in removing poles and stumps of the United Electric Light & Power Company in the burned district after the great fire in 1904. The claim of the city is for $632.40, with interest. An itemized statement attached to the bill of complaint shows that about 230 poles and stumps were removed.

BROCKTON, MASS.—A number of property transfers to the Edison Electric Illuminating Company have recently been recorded with the register of Plymouth for rights of way purchased by the company for carrying its power from this city to the new plant to be erected in the town of East Bridgewater.

CLINTON, MASS.—The Clinton Electric Light Company is making extensive alterations to its plant. A 1200-hp boiler is being installed and the stack is being repaired.

GARDNER, MASS.—Consideration of the proposition made by the Gardner Electric Light Company to the selectmen and taxpayers of Ashburnham was taken up at a special meeting last week.

HOLYOKE, MASS.—There is every reason to believe that the reports of the municipal plant for the present quarter will be extremely flattering to the officials having this department in charge.

LEE, MASS.—The Lee Electric Company has practically completed the improvements to its station, which meant almost the rebuilding of it. A new addition was built to accommodate the switchboard and a new engine and alternator was installed. The entire cost of improvements is in the neighborhood of $5,000.

MARLBORO, MASS.—The Marlboro Electric Company is installing a new boiler and a new engine and is planning for the erection of an elevated coal shed and pocket.

MIDDLEBORO, MASS.—The municipal lighting plant on which more than $100,000 has been expended and on which an additional expenditure of $20,000 is contemplated has been giving rather indifferent service of late. The lamps were extinguished on three different occasions one night last week, during which time the town was in darkness.

MILFORD, MASS.—The Milford Electric Light & Power Company was given permission to string wires and erect poles so that the town of Hopedale can provide lights for South Milford.

DETROIT, MICH.—Robert Oakman, who represented the interests of the Detroit United Railway, has obtained an option on the Pontiac, Oxford & Northern Railroad, running between Pontiac and Caseville, on Saginaw Bay. It has been understood the road would be extended to Bay City. The report now comes that the new management will experiment with the third rail between Detroit and Pontiac, twelve miles, and if it is successful the entire line will be thus equipped. Mr. Oakman stated when he obtained the option the road would soon be operated with electricity.

TRENTON, MICH.—This city will sell its municipal lighting plant to the Detroit Edison Company. This was decided at a mass meeting of the citizens. The company is to furnish electricity at a cost of $65 per year for each arc lamp to burn all night. The company is also to buy the present plant for $8,000.

MINNEAPOLIS, MINN.—The City Council has passed an ordinance providing that the city estimates for next year include an item of $500,000 for a lighting plant.

ALAMOGORDO, N. M.—M. H. Fisher, of this city, is making preparations for the installation of a power plant on the Fresnal, near the route to Cloudcroft.

ALBANY, N. Y.—Governor Hughes and the members of the State Water Supply Commission held a conference recently regarding the investigation the commission is about to start in order to devise plans for the progressive development of the water powers of the state for public use under state ownership and control. Thirty-five thousand dollars was appropriated to pay the expense of the investigation, and a preliminary report is to be handed in on or before February, 1908, and a final report on or before March 20, 1909.

ALBANY, N. Y.—Anticipating a favorable decision from the Public Service Commission on its application for permission to issue bonds amounting to $3,332,000 to finance the project, the Hudson River Power Company is now having the preliminary work on its great power dam on the Sacandaga River in the northern part of the State commenced. With the completion of the dam a lake will be formed which will exceed Lake George in size and electrical energy to the extent of about 200,000 hp will be available. This will make the Hudson River and its tributaries the most prolific source of water power in the country, with the exception of Niagara Falls. The lake will be about forty miles long and from two to three miles wide and the dam will be of solid masonry. The greater portion of the energy developed will be sent westward to Amsterdam and Utica.

BUFFALO, N. Y.—The second line for the transmission of energy from Niagara Falls to Syracuse is now ready for use. The Niagara, Lockport & Ontario Power Company hopes by this means to prevent delays which have been caused by thunder storms in the past. The two lines are from five to fifteen miles apart and are connected at the Solvay station.

IRONDEQUOIT, N. Y.—The Rochester Railway & Light Company, of Rochester, is reported to have secured the franchise to supply heat, light and power to the town of Irondequoit; estimated cost of this improvement is $20,000.

JOHNSTOWN, N. Y.—I. M. Everest, of Albany, a representative of the McCaffery Water, Motor & Power Company, of Troy, is stated to have secured water privileges along the Caroga and Peck creeks from Caroga Lake to the Mohawk River, and from Peck's Pond to its junction with Caroga Creek, and is seeking privileges in the vicinity of Johnstown on the said creeks. It is stated that several large power stations will be established in this locality to distribute power in Montgomery, Fulton and Herkimer counties.

LANCASTER, N. Y.—The Lancaster and Depew Light, Power & Conduit Company has started to build its new power house, a brick structure 60 x 80 ft. and two stories high. The company will use electricity supplied by the Niagara, Lockport & Ontario Power Co. for lighting Depew, Lancaster and Sloan.

NEWBURGH, N. Y.—The Public Service Commission of the second district has denied the application of the Newburgh Light, Heat & Power Company for permission to increase its capital stock from $500,000 to $750,000.

ROCHESTER, N. Y.—The city has charged the Rochester Railway & Light Company $1,363.29 for outages of arc lamps for the first six months of the year. Beginning with July 1 a new system for charging for outages was adopted in accordance with the lighting contract, which went into effect between the city and the Rochester Railway & Light Company at that time. Under this system a charge of 15⅞ cents per lamp per hour will be deducted, and if the same lamp is out a second night in succession the time is multiplied by five, and for the third and following nights again multiplied by five. The cost of city lighting under the new contract is about $5,000 a month less than under the old contract.

SARANAC LAKE, N. Y.—The power house of the Saranac Lake Light, Heat & Power Company was badly damaged by the bursting of a ten-ton fly wheel. The plant was, however, kept in operation, a reserve water wheel being placed in use.

SCHENECTADY, N. Y.—The long season of dry weather has caused a great scarcity of water in the streams of this vicinity. The Hudson River Electric Power Company, which operates large plants at Spier Falls and Mechanicsville, is feeling the effects of the scarcity of water keenly. At the former plant the amount of water is not sufficient to run all of the big generators, and at the latter place the plant is almost shut down. The Eastern New York Railroad Company was requested to start its own power plant, and Schenectady is being supplied with electricity from the plant at the General Electric Company's works.

SYRACUSE, N. Y.—Some of the members of the Syracuse Lighting Commission have expressed the opinion that municipal subways, such as are used in Baltimore, Md., would offer advantages in many ways for Syracuse over those of private corporations. Several of the committee who went to Baltimore were favorably impressed with the conduit system in that city, and the final report of the commission is expected to be made public within a month.

HICKORY, N. C.—M. E. Thornton, of Hickory, writes that the contract for constructing a concrete rock reinforced dam with power house across the Catawba River, at Hickory, and installing 3,000-hp turbine water wheels and electrical apparatus and transmission lines for lighting and power purposes, has been awarded to A. F. Hart & Company, of Hickory.

FARGO, N. D.—Manager Clark has completed his plans for enlarging the power plant of the Union Light, Heat & Power Company. The company will expend about $30,000 in improvements.

COLUMBUS, OHIO.—Bids will be received until Sept. 17 by the Board of Trustees of the Columbus State Hospital (Geo. Stockton, M. D., secretary), for furnishing and installing complete at the power house at the said hospital an engine, dynamo and switchboard. Frank L. Packard, architect, Columbus.

SPRINGFIELD, OHIO.—The stockholders of the new North Side Lighting & Heating Company are reported to have on Aug. 13 decided to incorporate with a capital of $50,000. The name of the company is not yet decided upon. The site for the plant has been purchased and contract will soon be let for the erection and equipment. A. J. Eisenmayer is acting chairman of the company.

NORTH BEND, ORE.—The City Council has granted a franchise to Seymour H. Bell for the construction of gas and electric plants in this city, the gas and electricity to be used for all purposes.

PORTLAND, ORE.—Water power plants on the Upper Sandy River, costing over a million dollars, and developing 25,000 hp to speed the cars of the United Railways Company is the latest power project. Water rights have been secured and negotiations are now being carried on with Eastern capitalists to finance the work.

ELIZABETHTOWN, PA.—A franchise has been granted to the Elizabethtown & Marietta Electric Light Company in order that it may compete with the Nanheim Electric Company.

HALLSTEAD, PA.—Surveyors will within a few days begin a survey for the purpose of determining the feasibility of carrying the waters of the Susquehanna River from Windsor to Landon through large iron pipes in order that it may be used for generating electricity. It is estimated that in flowing from Windsor to Landon the river has a fall of 130 ft. and that sufficient power can be generated to develop a 20,000 to 30,000 hp.

PITTSBURG, PA.—The Diamond Light & Power Company will introduce an ordinance in Select Council at the first regular meeting in September, granting the company a franchise. The new ordinance will differ from one introduced several months ago in that the time will be lengthened from 25 years to 50 years, and will bind the company to furnish electricity for arc lamps at a rate not to exceed $70 a lamp per year, and will offer 5 per cent of the net receipts each year as compensation for the franchise.

GARY, S. D.—Oscar Claussen, of St. Paul, Minn., is reported to be preparing plans for the proposed electric light plant. T. M. Anton, town clerk.

GEDES, S. D.—Work is under way for the construction of an electric light plant.

COLUMBUS, TENN.—The City Council is reported to be considering the question of improving the electric light plant.

KNOXVILLE, TENN.—At a cost of approximately $100,000 the Southern Railway is installing an electric lighting plant at Coster. When the plant will have been completed the Southern Railway will do its own lighting for all the yards in and around the city for the different depots and other buildings occupied by the company in Knoxville and at Coster. The determination to furnish its own light was reached some time ago and was followed up promptly by the work of installing the plant. The electrical equipment for the plant is already on the way, the building at Coster is being provided and poles are already being erected in the yards and adjoining the different buildings and depots used by the company.

TULLAHOMA, TENN.—The new power house, together with the electric generating equipment and water works plant, was turned over to the city last week. The new power station cost about $10,000.

GALVESTON, TEXAS.—Improvements to the amount of $120,000 are being made at the plant of the Brush Electric Light & Power Company.

GOLIAD, TEXAS.—The commissioners' court in session granted Dr. I. W. Chilton the privilege of erecting poles, etc., for an electric light plant in this city.

ABERDEEN, WASH.—The Gray's Harbor Electric Light & Power Company has a big crew at work on its power buildings being erected between here and Hoquiam.

TACOMA, WASH.—The Council, on Aug. 13, is stated to have decided to accept conditionally on election to be held Sept. 10, the bid of Geo. Milton Savage Company, at $1,750,000, for installing on the upper Nisqually River a municipal hydraulic power plant of 10,000 hp.

EAU CLAIRE, WIS.—The Chippewa Valley Light & Power Company is reported to have filed a mortgage for $1.000,000, and proposes using some of the funds for improvements and extensions.

KENOSHA, WIS.—The people of Kenosha are preparing for another fight over the question of municipal ownership of an electric light plant. So much opposition has been developed that it is certain that the Chicago & Milwaukee Railway Company, now building a power house at North Chicago, will seek to secure a contract for lighting Kenosha.

LACROSSE, WIS.—The Lacrosse Gas & Electric Company has applied to the State Railroad Commission for authority to increase its rates for electrical energy.

BATTLEFORD, SASK.—The contract for the installation of an electric power plant has been awarded to the James Stuart Electric Company, Winnipeg, selling agent for the Canadian Westinghouse Company.

DELHI, ONT.—The electric light plant of the Delhi Light & Power Company was put out of commission Aug. 11 owing to a break in the new cement dam. It will take from six weeks to two months to repair the dam, the cost being from $2,000 to $3,000.

EDMONTON, ALB.—The City Council has passed a by-law reducing the electric light rates by 10 per cent. This is the second reduction in two years, making the price 30 per cent below that charged when the plant was put in operation.

LLOYDMINSTER, ALB.—Morison Brothers will erect a power house and have received a grant from the town for this purpose.

NEW WESTMINSTER, B. C.—The British Columbia Electric Street Railroad is preparing to let a contract for the construction of a railway between here and Chilliwac. Address R. H. Sperling, general superintendent, Vancouver, B. C.

OTTAWA, QUEBEC.—The difficulty over the power supply for the municipal electric plant has been definitely settled. The Hydro-Electric Commission has executed the contracts with the Ottawa & Hull Power Company, and in turn with the city.

REVELSTOKE, B. C.—Sealed tenders will be received by A. Brown, Mayor, until 6 p. m., Sept. 6, for all labor and materials required for additional equipment and rearrangement of the civic hydro-electric plant, comprising a 500-hp producer gas plant and engines, generators and exciters, transmission machinery, switchboards, wiring, etc. Plans and general conditions may be seen at the office of H. Floyd, city clerk.

WINNIPEG, MAN.—The Manitoba Goverment has decided to accept the offer of Wilson Smith, of Montreal, Que., for the purchase of $500,000 telephone debentures at a rate to produce 4.43 per cent. This money will be used for the construction of Government systems here and at Brandon. The Manitoba Cabinet has decided to proceed at once with the construction of conduits and exchanges necessary for the systems.

New Industrial Companies.

THE CENTRAL STATION ENGINEERING COMPANY, of Frankfort, Ind., has incorporated, capitalized at $25,000. The object of the company is to do a general construction business, making a specialty of constructing and equipping central station, water, heat, light and power plants. Charles A. Gilham, Byron T. Gifford and David T. Wallace are directors.

THE CRESCENT ELECTRIC COMPANY, of Jersey City, N. J., has been incorporated with a capital stock of $25,000 by Henry W. Jachems, Henry M. Dickinson and Alfred W. Rake. The company will deal in electrical appliances, etc.

INTERNATIONAL ENGINEERING & CONSTRUCTION COMPANY, of Newcastle, Pa., has been incorporated with a capital stock of $25,000. The company proposes to build telegraph and telephone lines.

Company Elections.

REDLANDS, CAL.—At a meeting of the board of directors of the Home Gas & Electric Company, Delmont Locke was elected a director to fill the place of W. N. Campbell.

SALEM, N. H.—At the annual meeting of the Salem Light, Heat & Power Company held recently the following officers were elected: W. Du Bois Pulver, president; Levi Taylor, vice-president; William Lancaster, secretary, and Wallace Cole, treasurer.

STRATFORD, ONT.—At a meeting of the Stratford Gas & Electric Company held Aug. 14, the following officers were elected: W. C. Kennedy, president; J. P. King, secretary and treasurer; J. C. Baxter, managing director, and J. O'Loane and C. S. King, directors.

New Incorporations.

LESLIE, ARK.—The Leslie Telephone Company has been incorporated with a capital stock of $15,000. W. R. Foley is president.

LITTLE ROCK, ARK.—The Ozark Mountain Traction, Light & Power Company has been chartered with a capital stock of $200,000. The company proposes to construct an interurban railway between Russellville and nearby towns. The officers are: Adam J. Robinson, president; J. C. Wilson, vice-president; James Gould, secretary, and W. N. Langford, treasurer.

RUSSELLVILLE, ARK.—The Russellville & Ozark Mountain Traction, Light & Power Company has been incorporated with a capital stock of $200,000 by Adam J. Johnson, J. C. Wilson and James Gould and others, to build an electric railway from Russellville to adjoining towns, and to furnish electricity in the towns through which the electric railway runs. The first road will be built to Dover. It is reported that plans have been completed for a masonry and concrete dam to be constructed across the Illinois Bayou, near Russellville.

FRESNO, CAL.—The Fresno Home Light & Power Company has filed an article of incorporation with the county clerk. The company has a capital stock of $250,000 and will erect a $280,000 plant. The circuits will be all underground and the company proposes to connect seven or nine of its ornamental electric lamps in each block of the downtown business district.

LOS ANGELES, CAL.—The Santa Monica Gas & Electric Company has been incorporated with a capital stock of $250,000 by F. A. Crowe, G. E. Reid, A. C. Hurt, Marshall Davidson and U. L. Percey, all of Los Angeles.

ATLANTA, GA.—Articles of incorporation will soon be filed for an electric railway from Greenville, S. C., to Spartanburg, a distance of about 31 miles. The incorporators are A. A. Gates, C. C. Good, H. H. Prince and O. K. Maulden.

BOISE, IDAHO.—Articles of incorporation have been filed for the Lost River Electric Light & Power Company, of Mackay, Custer County, with a capital stock of $100,000 by Wm. J. McConnell, W. C. McConnell and Milton H. Cohn.

CHICAGO, ILL.—The Elizabeth Light, Heating & Power Company has been incorporated with a capital stock of $25,000 by Harry R. Murray, Frank M. Marvin and others.

FULTON, ILL.—The Fulton County Telephone & Telegraph Company has been incorporated with a capital stock of $2,500 by F. W. Platterberg and others.

MARSHALL, ILL.—The Telepost Company, with a capital of $18,000,000, has been organized in New York to construct telephone and telegraph systems to compete with the large present systems.

WATSEKA, ILL.—The Watseka Telephone Company has been incorporated with a capital stock of $35,000 by P. N. H. Musser, M. P. Turner and S. A. Walsh.

SOMERSET, KY.—Articles of incorporation have been filed with the Secretary of State for the Somerset & Nashville Railroad Company. The company is capitalized at $10,000, and proposes to build an electric railway from Somerset to Nashville.

KENNEWICK, ME.—The Priest Rapids Railway has filed articles of incorporation with the Secretary of State for the purpose of building an electric railway from Kennewick to Wenatchee. The company has a

capital stock of $1,000,000, and the officers and incorporators are: W. R. Rust, president; M. B. Haines, vice-president and treasurer; E. H. Guie, of Seattle, is secretary, and H. K. Owens is engineer. The principal office will be at Seattle.

OAKLAND, MD.—The Youghiogheny Light & Power Company, of Garrett County, has been incorporated at Oakland. The company proposes to erect a power plant below Deep Creek Falls, seven miles north of Oakland, at which point the water power of the Swallow Falls in Yough River, the Deep Creek Falls and the Muddy Creek Falls nearby, will be concentrated and utilized for the purpose of generating electricity. It is proposed to furnish electricity in Oakland, Mountain Lake, Deer Park, Grantsville, Accident, Friendsville and other towns in Garrett County, Kingwood and other towns in West Virginia and towns on the southern border of Pennsylvania, and also to supply electricity for the electric railways, one of which is to run from Frostburg to Uniontown, over a section of the old National Pike.

MEDFORD, MINN.—The Straight River Rural Telephone Company has been incorporated with a capital stock of $10,000 by G. O. Lee, W. H. Boynton, W. F. Eaton and W. A. Bailey.

PARK RAPIDS, MINN.—The Park Rapids & Lake George Telephone Company has been formed with a capital stock of $1,000.

SPRINGFIELD, MO.—At a meeting of the promoters and stockholders of the new North Side Lighting & Heating Company, which was recently granted a franchise by the municipality, it was decided to incorporate with a capital stock of $50,000.

SILVER CITY, N. M.—The Silver City, El Paso & Southwest Telephone Company has been organized by Clyde Smith, of Silver City; W. D. Murphy, of Central, and C. S. Bosworth, of Deming.

NEW YORK, N. Y.—Articles of incorporation have been filed with the Secretary of State for the Magnet Light Company. The company is capitalized at $10,000, and the directors are Nathan Greenburg, Samuel Eisenburg and Joseph Miller, of New York.

Legal.

RIGHT TO CONDEMN LAND.—In an action brought by the Indianapolis & Cincinnati Traction Company to condemn land for a proposed electrical transmission line, consisting of poles and wires, for the transmission of electricity from its power house to a station in Shelbyville, Ind., where the electricity was to be reduced in voltage and used for lighting and motive power in operating an interurban railroad, a number of objections were set up to the right of the company to acquire the land. Among other things, it was objected that the company had no power or right to exercise the privilege of eminent domain and appropriate the lands in question; and that the line, if erected, would constitute a nuisance. It was held that under the statutes of the state of Indiana, the company was empowered to condemn the land, and that the transmission of electricity over such a line would not be, per se, a nuisance. The law authorizes the construction and maintenance of lines for the transmission of electricity and the conduct of a lawful business is never a nuisance per se. Mull vs. Indianapolis & Cincinnati Traction Company, Supreme Court of Indiana, 81 N. E. Rep. 657.

RESPONSIBILITY FOR ACCIDENT.—The Privy Council of Canada has just rendered a decision on appeal in favor of the Montreal Light, Heat & Power Company in regard to an accident suit, in which the jury had returned a verdict against the company. It appears that the company had a 4000-volt transmission line on a public street. A contractor in erecting a fire station for the city of Montreal put up a derrick on the sidewalk in such a position that when the boom was swung out into the street to pick up stones, steel beams, etc., the steel hoist cable would come in contact with the bare conductors. Before the contractor had time to use the derrick the company warned the men in charge and also notified the contractor, in writing, receiving a receipt for the notification. After this had occurred the employees of the contractor fastened a rope to the boom of the derrick so that it could swing out a certain definite distance, but not far enough to come in contact with the wires. A week or two later a large stone out in the middle of the street was wanted, and in order to get it lifted by the derrick, the safety rope was untied to ensure wider range of action. When the steel cable became taut in the effort to raise the stone, it came in contact with the circuits, and the man at the crank handle was killed instantly by shock. A passerby who attempted to assist was also killed. As noted, the jury found against the company and exonerated the contractor, but when the case on appeal reached the King's Bench the adverse decision was reversed, and the Privy Council has now sustained the decision for the company.

PURCHASE OF PLANT.—An electrical company entered into a contract to furnish and install an electric light plant in the basement of the Hollenbeck Hotel, in the city of Los Angelos, the plant to consist of a dynamo of specified description, and a "Shepard cross-compound, vertical non-condensing engine." The electrical company, in order to carry out its contract, entered into another contract with an engineering company, under which the latter company agreed to furnish the engine and install both the engine and the dynamo. In this contract the engineering company guaranteed the engine from any defects or flaws for the period of one year, unless it could be shown that such flaws or defects resulted from the unskilful management of the machinery. The plant was installed and everything ran perfectly for eleven days when it was turned over and entrusted to the care of the hotel people. Thereafter in an action by the engineering company to recover the balance due on the purchase price of the engine the electrical company claimed not to be liable in that the engine was defective and, when operated, caused a loud and continuous knock or pound and also a constant flickering in the lamps. It could not be denied that the lamps fed from the plant flickered and that the engine, when operating the dynamo, produced the "knock" or "pound" as claimed. But the plaintiff argued that this was due, not to any defect in the engine, but rather to its unskilful management. One expert testified that there was no bump or knock discernible when the engine was first started, nor until after the hotel people had taken complete control of it, and that it was the quietest direct-connection engine he had ever seen. Other experts testified in the same tenor. It was held that the engine was not defective, that neither the flicker nor the pound was due to any fault of the engine, and that the defendants were liable for the unpaid balance of the purchase price. Tracy vs. California Electrical Works, California Court of Appeals, 90 Pac. Rep. 461.

COMPANY NOT RESPONSIBLE FOR DEATH.—An action against a power company for damages, which was the subject of a recent decision of the Supreme Court of Wisconsin, brought forth the following facts: A fire occurred in Oshkosh, which was known as the "Plummer Fire." In the rear of the Plummer store, at the outer edge of the sidewalk, stood a telegraph pole on which were strung numerous telephone and other electric wires, among them being four wires belonging to the defendant power company, carrying about 2200 volts each. The pole was badly burned during the conflagration, and all of the wires attached to the pole, except those of the defendant company, were removed on the day of the fire. Three days after the fire one Zentner, who was the defendant's only lineman, was ordered by the defendant's general superintendent to replace the burned cross-arm. Zentner proceeded with his work and succeeded in replacing two of the cross-arms without mishap. Later in the day he was discovered leaning across the high-voltage wires, the insulation on which had been burned away by the fire, and when he was reached life was extinct. Two engineers in the employ of the defendant testified that for four years prior to the accident the current had never been turned off for the purpose of making outside repairs. If the company was liable it was upon the ground that it was guilty of negligence in not shutting off the power during the progress of the repairs and, the evidence to the effect that it was customary to allow the power to remain on while repairs on wires were being effected being uncontradicted, judgment was given for the defendant. Zetner had assumed the risk and his estate was not entitled to damages. Risks of employment are always assumed when the servant knows or ought to have known the dangers incident to the conditions under which he works, and all ordinary risks and hazards of the occupation in which he is engaged are assumed, whether the servant appreciates them or not. Zentner, by engaging in the work of a lineman for the defendant company, assumed the ordinary risks incident to such employment. It would be presumed that he was aware of the condition of the wires in question, and, having knowledge thereof, though presumptive merely, he accepted the risk, which precluded any recovery of damages against the company. Zentner vs. Oshkosh Gaslight Company, 112 N. W. Rep. 449.

DUTY TO INSULATE WIRES.—In the jurisdiction of Texas an action was brought against an electric company and a telephone company jointly for damages for the death of an inspector in the employ of the telephone company. The two companies maintained lines of poles along the same right of way and two of the electric company's wires, carrying deadly currents of electricity, passed in close proximity to one of the poles of the telephone company. The wires had burned out by coming in contact with the pole and a man was sent to make temporary repairs. He fixed them so that they would work that night and left an order for the lineman to repair them permanently. One of the linemen testified that he found the wires in bad condition and that he fastened them to the telephone pole, intending later to solder and fix the joints, but that he "just neglected it, that is all." While ascending the pole to attend to the telephone wires, the inspector, without any knowledge of the danger thus created, came in contact with the unrepaired wires and met instant death. It seems that there was in force in the city an ordinance regulating and governing the construction and maintainance of wires for conducting electricity, which stated, in substance, that live wires must have an approved weather or rubber insulating covering, and be so spliced or joined as to be both mechanically and electrically secure without solder, and that the joints must then be soldered to insure preservation, and covered with an insulation equal to that of the conductors. The electric company sought to shift the responsibility on to the telephone company by pleading that the latter company allowed its pole to lean to one side, and that the accident would not have occurred had the pole been perpendicular. The blame, however, was allowed to remain with the electric company, and a verdict of $16,000 was the result of the deliberations of the jury. The failure of the company to keep its wires insulated was, by reason of the ordinance, negligence in itself. The duty of the proper maintenance of the wires was expressly imposed upon the company, and it was held that the fact that the dangerous condition of the wires was due to the company's employes failing to finish their work, and leaving it in a half-completed condition, did not detract from its character as an act or omission on the part of the company itself. San Antonio Gas & Electric Company vs. Badders, Court of Civil Appeals of Texas, 103 S. W. Rep. 229.

SUPERIOR, WIS.—Articles of incorporation have been filed with the Secretary of State for the Interstate Transfer Railway Company. The company is capitalized at $600,000, and the incorporators are: S. L. Perrin, W. W. Savage, of Superior; Joseph B. Cotton, George L. Reis, and William A. McConagle, of Duluth, Minn. The company proposes to build a railway connecting Superior and Duluth, a distance of 20 miles.

Personal.

MR. C. McK. PARR has established headquarters at Greensboro, N. C., for the Electrical Material Company of Baltimore, Md.

MR. D. H. FOOTE has been elected secretary of the Pacific Gas & Electric Company and of the California Gas & Electric Corporation, succeeding C. W. Conlisk.

MR. W. G. MIDDLETON, of the Tri-State Telephone Company, St. Paul, Minn., has been appointed assistant provincial telephone expert for Manitoba to assist Orrin F. French.

MR. C. M. BUNNELL, formerly assistant manager of the Birmingham, Ala., office of the Southern States Electric Company of Atlanta, has joined the sales organization of the Westinghouse Electric & Manufacturing Company, being attached to the Atlanta headquarters of that corporation.

MR. HUGH J. McGOWAN, president of the syndicate traction lines in Indiana, who, with his family has been traveling in France, Switzerland and Ireland, returned on Aug. 28. Mr. McGowan found several knotty interurban questions to deal with upon his arrival.

MR. A. A. TIRRILL and family were passengers on the steamship *Finland*, which arrived in New York, Tuesday, Aug. 20. Mr. Tirrill, who is the inventor of the Tirrill regulator, has been in Europe for the past four months in the interest of the General Electric Company, which is now manufacturing this regulator.

MR. J. B. KENNEDY has resigned as the New York representative of the Wirt Electric Company, Inc., of Philadelphia, now owned by the Cutler-Hammer interests. He is now engaged in the chief engineer's office of the Department of Water Supply, Gas and Electricity.

MR. CHARLES C. MORDOCK, formerly manager of the Terre Haute Traction & Light Company, of Terre Haute, Ind., has been appointed a permanent member of the board of expert engineers of the Stone & Webster Engineering Corporation, Boston, Mass. Mr. Mordock will make his headquarters in Boston.

MR. PUTNAM A. BATES is building a home for himself at Madison, N. J., which is intended to be a model of electrical installation and use of domestic devices for cleanliness, convenience and economy in operation. He is also engaged on equipments for Mr. C. W. Harkness, of Madison, and Mr. Clyde Fitch, at Katonah, N. H. He is to lecture this winter before the Franklin Institute on the equipment of country houses and farms with electricity.

MR. M. A. VIVIEN, of the Marconi Wireless Telegraph Company, arrived here this week on *La Touraine* to inspect the Marconi system in this country. He is enthusiastic over the great progress the wireless is making on both sides of the Atlantic. The Marconi Company, he predicted, will, within a few months, be able to compete with the cable companies. "Marconi," he said, " is now at the high power station at Cape Breton perfecting the apparatus there, and at the same time the work of perfection is under way in England, so that within a month it is expected the company will be in direct wireless communication from the continent to England, and we will be able to send and receive messages, thus entering into competition with the cable companies." Mr. Vivien will remain on *La Touraine* for a few days perfecting the wireless outfit on the liner. The French line, he announced, will equip its steamships with powerful instruments, so that it will be enabled to keep up communication with Europe and America all the way across. Mr. Vivien will go from here to inspect the station at Cape Cod.

Trade Publications.

THE GENERAL ELECTRIC COMPANY has issued Bulletin No. 4521 for July devoted to its floor outlet boxes, which are adjustable and watertight. They are described and illustrated in detail.

THE SPRAGUE ELECTRIC COMPANY has issued a second edition of Price List No. 423, which includes several new types of fittings for use in connection with Greenfield flexible steel conduit and flexible steel-armored conductors. The publication of this edition has been necessitated through the addition of new types of boxes and box fittings and by the reduction in price of several types of boxes. Owing to these changes, new discounts on all conduit materials listed in Price List No. 423 have also been sent to the trade.

Business Notes.

THE HOLOPHANE GLASS COMPANY has just established an office and stockroom, with demonstration room, at 298 Wabash Avenue, Chicago, telephone, Harrison 329, in charge of Mr. C. A. Howe, who will be manager of the Western department. A stock of globes and reflectors will be kept for quick delivery in and near Chicago, which will doubtless prove a great convenience to customers who have heretofore secured their orders through the New York headquarters.

DOUBLEDAY-HILL ELECTRIC COMPANY, of Pittsburg, Pa., announces that its Charlotte (N. C.) warehouse is now open and ready to take care of the requisitions for the Southern trade. The stock is large and comprehensive, covering the best lines of material, such as "O. K." weatherproof wire and "Parac" rubber covered wire, Bryant, Perkins and Paiste materials, Emerson alternating-current desk and ceiling fans, "Peerless" lamps, Hubbell specialties, etc. From this stock the demand of the lighting stations, electrical contractors, street railway companies and telephone companies can be promptly supplied.

THE CONTINENTAL FIBRE COMPANY, of Newark, Del., incorporated last year, reports such a demand for its product that it has already been necessary to double the capacity of its plant. These improvements are now about completed, and the usually active fall trade will find it equipped to make immediate deliveries in practically unlimited quantities. The success of this firm may be attributed to its long and intimate connection with the vulcanized fibre business, each of the incorporators having been connected with the industry since its infancy, together with sufficient capital and a thorough organization, offices being maintained throughout this country and Europe.

HARTFORD MACHINE COMPANY.—At Hartford, Conn., on Aug. 21, the new four-story addition to the plant of the Hartford Machine Screw Company was the scene of much good fellowship, when the dedication of the building took place with about 1000 persons present, including officers of the company, employees and friends. Mayor William F. Henney, in behalf of the employees of the company, presented to Philip B. Gale, vice-president and general manager of the company, a silver loving cup of rich and handsome design. Mr. Gale was wholly unprepared for this part of the programme, but as soon as Mayor Henney had completed his remarks, the former was ready with a response that clearly showed his appreciation of the friendly attitude in which he is viewed by those who are under him in the factory. Mr. S. E. Doane, superintendent of the factory and chairman of the committee having the dedication of the new addition in charge, spared no pains in making the event pass off smoothly. The entertainment was on a large scale, and in many ways was unusual. Both of the rooms which were dedicated were as clean as the model housewife's kitchen, and were it not for a small part of the shafting that had been placed one would hardly realize that he was in a large factory. The new addition to the factory plant consists of the third and fourth stories in the building known as No. 9. The machinery will all be installed by this week and the wheels will be in motion. The building is of brick, 275 feet long by 60 feet wide. The work on the addition was begun about three months ago.

Weekly Record of Electrical Patents.

UNITED STATES PATENTS ISSUED AUG. 20, 1907.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

863,609. ELECTRICALLY SIGNALING FROM MOVING TRAINS; Alva D. Jones, Louisville, Ky. App. filed Dec. 3, 1906. An apparatus actuated by the steam or smoke issuing from a locomotive for completing an electrical circuit to operate signals, etc., by chemical means, as the train passes.

863,613. MEANS FOR OPERATING THE CONTROLLING SWITCHES OF ELECTRIC VEHICLES; Louis Krieger, Paris, France. App. filed Jan. 10, 1906. Relates to steering column for automobiles and has a switch arranged co-axially within the column and operated by a handle projecting axially therethrough in the manner of an ordinary train controller.

863,617. COMBINED TELEPHONE RECEIVER AND TRANSMITTER; R. F. Ludlow, Philadelphia, Pa. App. filed April 6, 1904. In a telephone, a combined receiver and transmitter comprising a casing containing two compartments, an electromagnet in one compartment, a variable resistance conductor in the other compartment, but in series with the windings of the magnet, a single diaphragm, and means extending through the first-mentioned compartment directly connecting the diaphragm with the resistance conductor.

863,629. COMBINED DROP AND JACK; James M. Overshiner, Chicago, Ill. App. filed May 31, 1904. A combined drop and jack comprising a shutter, and a movable device adapted to be engaged by a non-entering portion of a switch plug, when the plug is within the jack, and adapted also to engage and move relatively to the said shutter, whereby the said shutter is automatically restored by the endwise movement of the plug in the jack.

863,643. GRINDING MACHINE; George P. Ransom, Oshkosh, Wis. App. filed May 29, 1907. Construction of motor-driven grinding machine having a grinding wheel and means acting on the periphery of the wheel for controlling a rheostat so that a predetermined speed for a given wheel will not be exceeded.

863,656. SAFETY FUSE; Joseph Sachs and Frank D. Reynolds, Hartford, Conn. App. filed March 22, 1906. The usual fiber tube of a fuse has a U-shaped slot on one side through which an indicating fuse extends so as to form an indication when the main fuse is blown.

863,667. RELAY; Jacob Struble, Wilkinsburg, Pa. App. filed Feb. 18, 1907. Construction of relays for use in railway signaling in which sectional track rails charged by an alternating current and connected by inductive bonds are used.

863,674. JOINT FOR CARBON ELECTRODES; Frank J. Tone, Niagara Falls, N. Y. App. filed Sept. 25, 1906. A joint for carbon electrodes

comprising pieces having tapered ends and sockets respectively threaded to engage one another.

863,683. BRUSH HOLDER FOR ELECTRIC MOTORS OR THE LIKE; Thomas S. Watson, Milwaukee, Wis. App. filed Sept. 1, 1906. A brush holder comprising jaws having oppositely disposed parallel ways tapered in cross section to form guides, the brush having taper edges corresponding to said guides, with which they are engaged.

863,690. TROLLEY DEVICE; Samuel E. Belcher, Los Angeles, Cal. App. filed Jan. 10, 1906. Provides means by which the trolley wheel may be expeditiously re-engaged when it has left the wire by means of pneumatic pistons connected to impart a vertical movement to the pole.

863,602. SYSTEM OF ELECTRICAL DISTRIBUTION; William L. Bliss, New York, N. Y. App. filed July 20, 1904. System in which a motor is driven from the wheel axles of a train and including a storage battery and regulator by which the current is maintained constant regardless of changes of speed or direction of the train.

863,705. TELEPHONE SIGNAL SYSTEM; Hoard M. Eldred, Milwaukee, Wis. App. filed March 19, 1906. Drop signal and key for party line system.

863,720. TELEPHONE CALL BELL; William Kaisling, Chicago, Ill. App. filed March 2, 1906. A polarized call bell or ringer comprising substantially parallel electro-magnets having cores provided with projecting threaded ends, an armature supporting yoke extending between said ends and a single adjustment nut on each of said threaded ends having a peripheral groove into which the adjacent ends of the yoke project.

863,755. CONTROLLING APPARATUS FOR RAILROAD SIGNALING; Petrus J. Portman, Amsterdam, Netherlands. App. filed June 8, 1906. System operated by magnetic induction by which an engineer is kept notified of the condition of the trolley conductor both ahead and behind his train.

863,773. LIGHTNING ARRESTER; Ernst J. Berg, Schenectady, N. Y. App. filed Jan. 8, 1907. A lightning arrester comprising a reactance, condensers in parallel therewith, a ground connection for said condenser, and a separate discharge path to ground through a spark gap.

863,774. PARALLEL CONNECTED GENERATORS; Ernst J. Berg, Schenectady, N. Y. App. filed Jan. 17, 1907. A direct-current generator comprising a series field winding opposing the main field magnetization, and a reactive coil shunting said field.

863,791. PROTECTIVE DEVICE; Loren Emery, Schenectady, N. Y. App. filed Jan. 10, 1907. A protective device adapted to open the circuit either on an overload or by a reversal of energy and which is arranged with a time limit device operative on normal overload but inoperative on an excessive overload or a reversal of energy. Apparatus may be used on direct or alternating current circuits.

863,799. ELECTRIC METER; Charles E. Holmes, Lynn, Mass. App. filed Nov. 23, 1904. Construction of electric motor having a casing and an operating mechanism, and means for detachably supporting the entire operating mechanism within the casing, and a yielding member which when depressed permits of removing the entire operating mechanism from the casing.

863,674.—Joint for Carbon Electrodes.

863,807. SNAP SWITCH; Frank W. Sanford, Schenectady, N. Y. App. filed Feb. 1, 1905. A two-button snap switch having a switch blade spring impelled into either one of two limiting positions, and a spring follower motion controlled by a detent for impelling the switch arm at the limits of movement of the operating buttons.

863,808. DIAL PLATE FOR SWITCHES; Howard R. Sargent, Schenectady, N. Y. App. filed Aug. 24, 1905. A rotary switch having a rotatable spindle and a switch contact having upwardly extending portions and a dial plate supported on said portions.

863,810. TELEGRAPH KEY; Henry Smith, Raleigh N. C. App. filed July 17, 1906. Telegraph transmitter of the type having one button for sending dots and another for sending dashes. Has a sectionally arranged vibratory spring engaging a plurality of contacts different ones of which are effective upon depression of different keys.

863,814. DYNAMO ELECTRIC MACHINE; Louis E. Underwood, Lynn, Mass. App. filed April 9, 1904. In a dynamo-electric machine, a frame, polar projections extending therefrom, and sheet metal tanks or receptacles located in the spaces between adjacent polar projections.

863,818. RAIL BOND; Ben Willard, New Orleans, La. App. filed March 31, 1899. In order to obtain better contact of the bond with the rail, patentee has a single strand conductor provided at its ends with a plurality of contacts fixibly connected to one another.

863,847. ELECTRICAL SOCKET SEAL; Llewellyn T. Hatfield, Sacramento, Cal. App. filed Aug. 3, 1906. The lamp socket has a cavity which receives a plug engaging the base of the lamp to prevent its removal. This plug is sealed in place by a wax or lead seal.

863,852. TRANSMISSION OF INTELLIGENCE BY ELECTRIC MEANS; Isidor Kitsee, Philadelphia, Pa. App. filed Feb. 5, 1904. Circuits for telephone system. Electric transmission line having two local circuits more or less remote from one another and joined by a transmission line, each of the local circuits having a value at least equal to the value of the line.

863,853. TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed April 24, 1907. Duplex telegraph system having two sources of current in opposition to one another and means for grounding sectional windings of an electromagnetic device at each station.

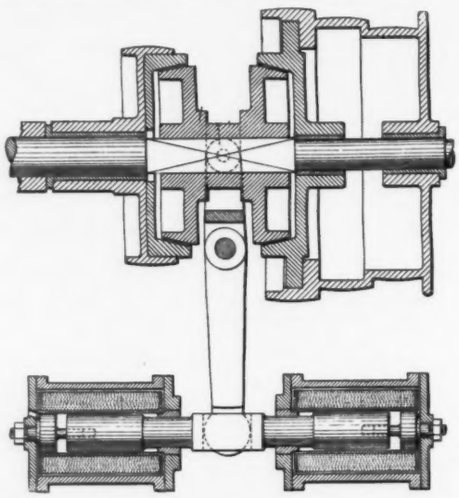
863,875. SYSTEM OF SELECTIVE ELECTRIC SIGNALING; S. A. Reed, New York, N. Y. App. filed Aug. 4, 1906. In a selective system, a circuit containing condensers and oppositely biased ringers respectively in series, a source of current and a resistance, in combination with a periodic switching device for charging said condensers alternately with charges of opposite polarity and adapted to interpose said resistance into the condenser circuit during the change from maximum positive charge to maximum negative charge or vice versa.

863,913. BLOCK SIGNALING APPARATUS; Walter E. Foster, Chicago, Ill. App. filed April 25, 1907. Has a signal locking device arranged to be operated by a reversal of the line polarity, and means whereby the passage of a train into and out of a block automatically reverses the line polarity and thereby operates such lock.

863,924. SELECTIVE SIGNALING SYSTEM; William E. Foster, Buffalo, N. Y. App. filed May 28, 1907. In a selective signaling system, the combination with a source of signaling current, switching mechanism for applying such current of requisite polarity to the line, a line or signaling circuit, and a plurality of sub-stations connected thereto, each equipped with polarized signaling apparatus, a condenser and means for opening and closing the circuit to the condenser, substantially as set forth.

863,934. SLOW-SPEED MECHANICAL RELEASE; Walter P. Neubert, Swissvale, Pa. App. filed April 30, 1906. A slow-speed mechanical device for controlling an electric circuit on electric locks or levers for controlling a switch or signal. Has a worm and gear which can only be turned in one direction to operate the switches.

863,955. INTERRUPTER APPARATUS; Reinhold H. Wappler, New York, N. Y. App. filed Oct. 30, 1906. Interrupter for the primary circuit of an induction coil for a wireless apparatus having a vibrator which is mechanically operated by a cam shaft.



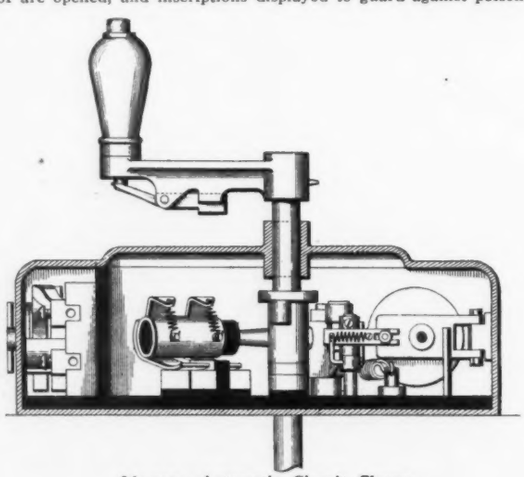
863,966.—Electromagnetically-Operated Mechanism for Reversing the Motion of Machine Tools.

863,966. ELECTROMAGNETICALLY-OPERATED MECHANISM FOR REVERSING THE MOTION OF MACHINE TOOLS; Julius Billeter, Aschersleben, Germany. App. filed Oct. 25, 1906. A pair of friction cones moving in opposite directions may be selectively engaged by a central cone or clutch moved by solenoid magnets.

863,969. TELEGRAPH AND TELEPHONE CABLE CORE; William Dieselhorst, Old Charlton, and Arthur W. Martin, London, England. App. filed March 29, 1904. A method of making telephone cables which consists in twisting together pairs of individual conductors with a constant length of lay from end to end of each twisted pair, and again twisting the twin conductors in pairs, but with a different length of lay.

863,984. TROLLEY; Nelson J. Greenison, New York, N. Y. App. filed Jan. 28, 1907. The trolley wheel is swiveled on a vertical axis on the end of the trolley pole and is constrained to move within a limited arc of angular movement by gears or lugs thereon.

863,985. MEDICINE CABINET; John Haller, Chillicothe, Ohio. App. filed Jan. 6, 1906. A medical cabinet having alarm devices and bells so that the various compartments are illuminated when the doors thereof are opened, and inscriptions displayed to guard against poison.



864,027.—Automatic Circuit Closer.

863,992. BRIDLE RING; William J. Hiss, Jr., New York, N. Y. App. filed March 18, 1907. A bridle ring having an arm, the lower portion of the arm being bent back upon itself to form a ring, and a cover plate.

864,027. AUTOMATIC CIRCUIT CLOSER; Henry A. Pearson and Harry Adams, United States Navy. App. filed Oct. 22, 1906. Automatic circuit closer applied directly to the controller shaft in connection with a circuit breaker, all the parts being enclosed in the same casing.

864,129. CONTROLLING MECHANISM FOR ELECTRIC SIGNALING SYSTEM; Willard H. Gilman, Medford, Mass. App. filed Oct. 31, 1906. Controlling apparatus having an electromagnet and armature and a contact device made and broken by successive reverse movements of the armature and a second contact device made and broken upon each movement of the armature and locking means for preventing the operation of one of the contact devices.